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Integration of more Renewable electricity in the CEE region: network or support

Proceedings of the Roundtable in Budapest on the 20-21 May 2008

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Information on the co-organiser

The Regional Centre for Energy Policy Research (REKK) was founded in January 2004 at the Corvinus University of Budapest (formerly known as the Budapest University of Economic Sciences and Public Administration). Its staff includes university teachers from the field of interest of the Centre, a research fellow of the Institute of Economics (Hungarian Academy of Sciences), full-time research fellows and graduate sholarship students. Apart from scientific and methodological experience, the staff possesses considerable regulatory and public administration expertise.

REKK is an independent non-governmental organization financed by cooperative agreements and commercial contracts.

The purpose of REKK is to provide professional analysis and advice on networked energy markets that are sustainable both commercially and environmentally. We believe that the Hungarian experience of the last decade on restructuring and regulating energy markets and the related research are applicable to other CEE countries as well, therefore our aim is to operate on the regional level.

The aims of REKK are twofold:

- carry out high standard policy oriented research for the energy market actors focused on energy policy, regulations and investment needs; and
- use these research results for educational purposes.

Our partners:

- central and local governmental organizations
- international organizations
- energy companies
- non-profit organisations

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Proceedings of the roundtable on:

Integration of more Renewable electricity in the CEE region: network or support problem?

Budapest
20- 21 May 2008

- ***Organisers:***
  - ***Joint Research Centre (JRC) of the European Commission, Institute of Energy, Renewable Energy Unit***
  - ***Regional Centre for Energy Policy Research (REKK)***

Presentations:

Harry Lehmann	Necessary policy elements to overcome barriers that prevent the integration of RES-E
Jorge Vasconcelos	Renewable energy: new challenges for regulators and network operators
István Pataki	The new RES regulation: the Green Package in Hungary
András Mezősi	Economic analysis of energy storage requirements in connection with RES-E
Christos Protogeropoulos	New Legislative and Regulatory Measures for the Development of RES Technologies & Applications in Greece and Experiences Encountered after Two Years of Programme Activity
Göran Koreneff	Effects of large-scale increase of RES-E with the focus on the spot market price levels in the Nordic Power system
Tamás Tóth	Specific economic details of the RES regulation (penalties for wind generators due to production outside the schedule)
Vaida Tamašauskaitė	Wind Projects integration in Lithuanian Electricity Network
Vaclavas Kveselis	Renewable Energy Sources for electricity production: status in Lithuania
Hanna Bartoszewicz-Burczy	Renewable Energy Sources in Poland–Evolution, Current State and Possibilities of evelopment
Dan Teodoreanu	The Renewable Energy Sources in Romania – Elements of the proposed RES legislation
Corneliu Radulescu	Renewable Energy Sources and Energy Efficiency in Romania in the light of the EU legislation
Rostislav Krejcar	The latest issues with RES-E development in the Czech Republic

Preface to the proceedings

Introduction

The European Commission has the task and the mandate to continuously monitor and evaluate the progress achieved in implementing Renewable Energies and Energy End-Use Efficiency. Therefore it is indispensable to have up-to-date references in this important field of sustainable development.
It stimulates common and harmonised socio-economic tools for energy strategy concerning the implementation of new and emerging energy technologies.

The Renewable Energy Unit (Scientific Technical Reference System) aims to increase the common understanding and to give unbiased, reliable and organised information on Renewable Energy and Energy End-Use Efficiency. This is done by generating better up-to-date input required for monitoring of existing European policies and legislation and by collecting data from statistical offices and other relevant institutions.

In this respect the analysis of diverging trends in Renewable Energy Sources (RES) application in the various Member States, and identification of the driving forces behind the different trends is an important mission of the Renewable Energy Unit (REU). This can reveal which policy approaches perform better in the various socio-economic environment and by their comparison and dissemination it can foster the selection of the most appropriate policy tool for decision makers. Within this framework the Renewable Energy Unit has organised a roundtable with experts in the field from the different Member States.

Renewable energy use and the projected shares of the renewable energy sources (RES) in the final energy mix show positive tendencies all over Europe. Beyond the positive impression one can draw from the increase, there are signs that there are some diverging tendencies among different groups of countries. The first impression from the target shares in the final energy demand is that the more and less ambitious RES targets are distributed more or less evenly between the groups of the EU 12 and EU 15 countries (Figure 1). Targets vary significantly across the countries but from both groups (indicated with red and blue columns) one can find high and moderate RES shares in final energy demand targets. The first presumption is that these targets are not influenced by which group a country belongs to but there are other factors behind these differences.

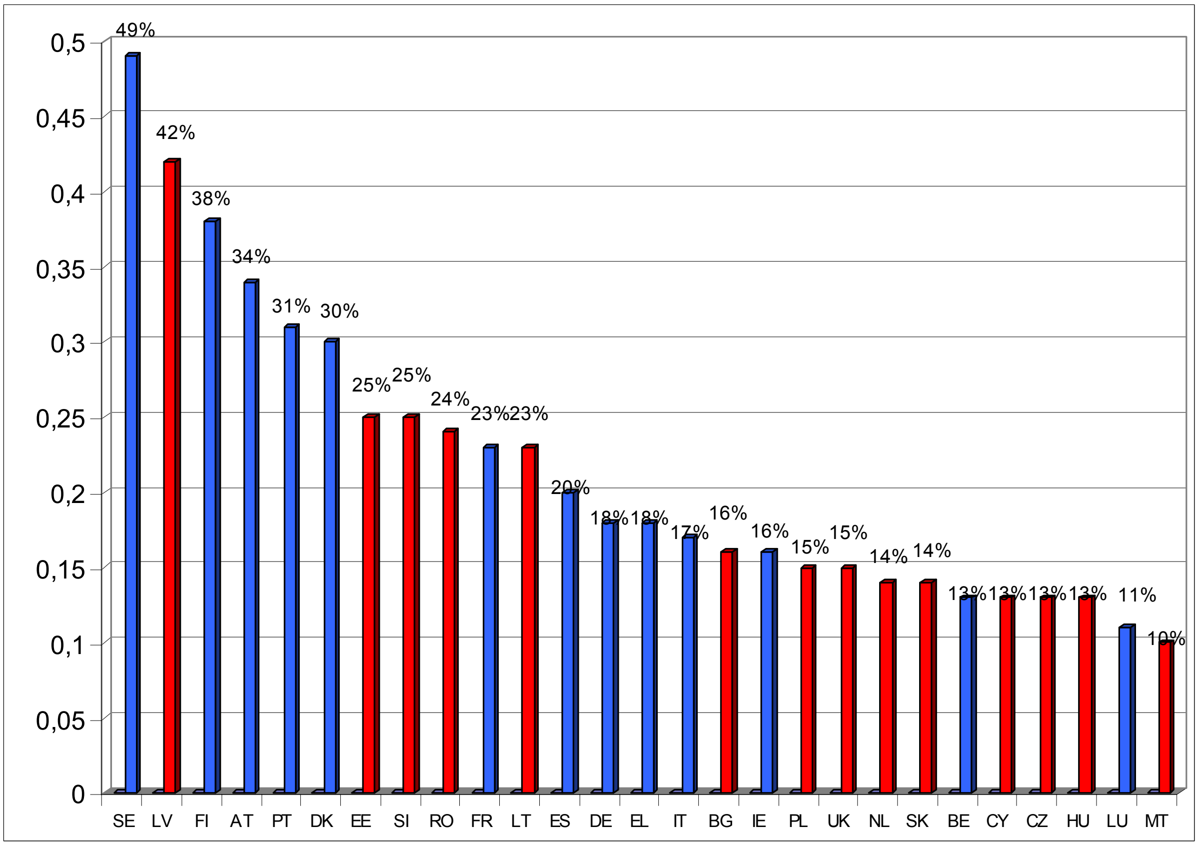


Figure 1. The 2020 target shares of renewables in the final demand in the EU27 (Eurostat)

By taking a closer look at the RES-E distribution and 2010 targets one can recognize that the countries with high RES-E shares from the EU12 group all heavily rely on the hydro sources, so the high Latvian, Slovenian and Slovakian RES figures indicate that the other renewable sources are utilised at a low level (Figure 2). The utilisation level of hydro sources are the most difficult ones to increase: both the expansion of utilisation rate and finding sites for new capacities are limited. This has further implication: the increase of the target level compared to the existing utililisation level is much less within the EU12 country group. Those countries that already had gained experience with higher shares of RES in their electricity generation portfolio use accelerated RES deployment in their projections. This suggests that instead of positive spillover from the countries with extensive experience the gap opens up wider between these two country groups. An efficient policy aiming at a harmonisation of European RES development has to address this potential problem.

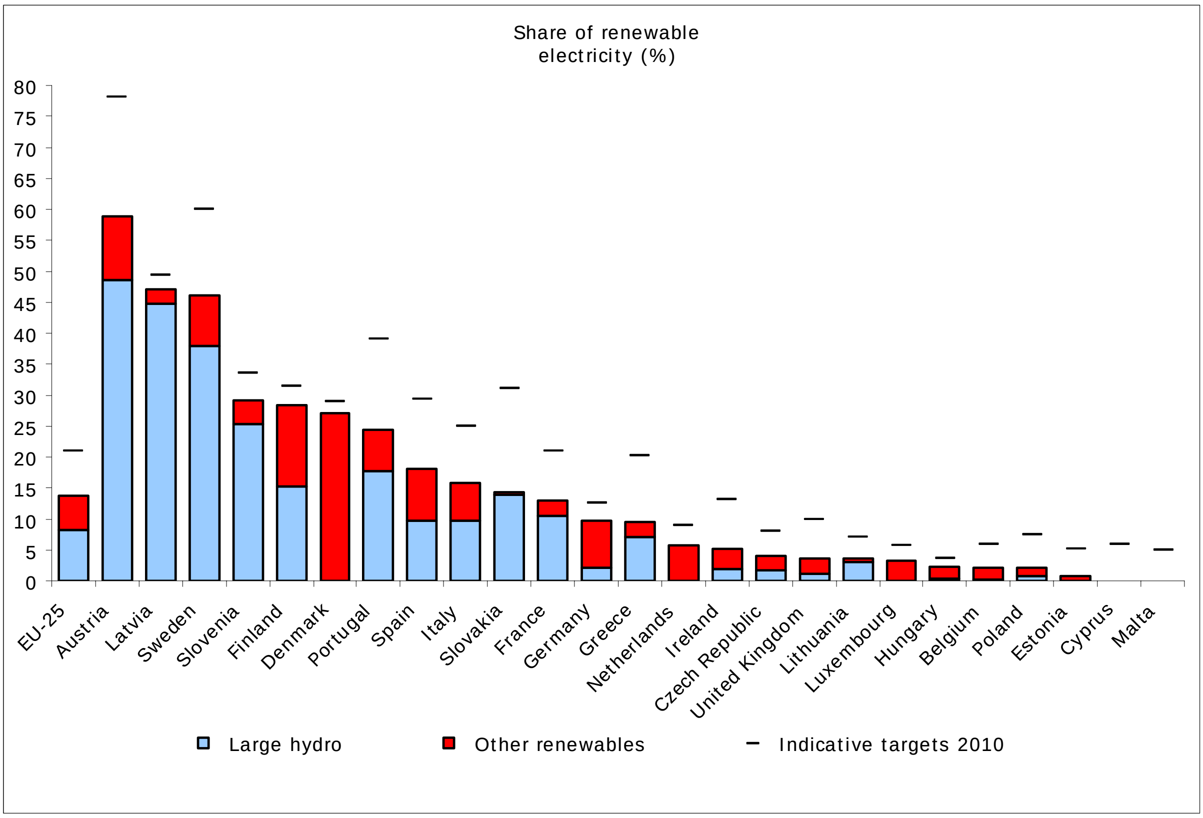


Figure 2 Share of RES-E and the corresponding policy targets for EU25

In this context the roundtable had a twofold objective. First it aimed at classifying and ranking the most important factors in CEE countries impeding a more rapid deployment of renewable energy sources for electricity production (RES-E). We used the following problem classification:

- Financial
  - Regulative – support measures
- Institutional
  - Network management -infrastructure
    - Trans-Boundary Power Exchange (Cross-Border Issues)
    - Power Systems Interconnection / Fair third party access rules
  - Market structure/concentration

The second objective was to identify efficient ways to overcome these barriers from demonstrations of successful examples from Member States with longer RES-E integration experience. Some of the best available techniques and country experience with the different policies were presented at the roundtable. The invited experts shared their experiences gained at various institutions: energy regulation offices, grid operating entities, energy production units and quite a few in energy related research organisations. Beside the positive examples, the barriers that exist in the various member states were also discussed.

The roundtable proceeding may help the stakeholders in the identification of their strategic benefits from RES integration.

The more rapid development of RES can offer advantages for all stakeholder groups: this win-win situation can be realised if all stakeholders of the market and regulation would be informed better how to benefit from the increased diversification offered by RES. The major benefits can be identified as the following for the stakeholders.

- Regulators can get a better understanding how the problems of larger scale integration the RES sources were overcome in different countries. More sophisticated regulatory mechanisms and better information systems can strengthen the position of regulatory bodies. Improving market conditions, bidding procedures, (ie. day and hour ahead market instead of the monthly schedule), embedding forecasting systems will lead to enhanced regulatory regimes.

- Grid operators are interested in the DER integration challenges, system loss reduction, access conditions, integrating output forecast from intermittent generators that can contribute to improved grid operation methods.
- Power production investors seek low volatility, secure cash flow (feed in tariff), diversification, immunity from oil price changes and carbon prices.
- Researchers quest for innovation and cost reduction by technological learning.

The current proceedings of the roundtable focus on the crosscutting issues that were discussed in more presentations or were emphasised by many participants rather than summing up the country presentations. Those interested in the country specific topics can search for the required information in the attached presentations.

Crosscutting issues discussed at the roundtable

Communication of RES benefits

Primary task to secure RES development is to inform all stakeholders about its advantages. Only by communicating and understanding the benefits of higher RES shares in the energy mix can trigger their deployment. Without awareness of the benefits it is impossible to raise the willingness to pay to the adequate level: the consumers should be conscious that RES will pay back the money they invest in it. They key factors of benefits to communicate are:

- Climate protection
- Independence of fossil fuel imports
- Reduction of (international) conflicts
- Low risks for humans and environment
- Local economic and social development especially for poor countries
- Fostering industrial development and export opportunities

Political framework conditions for RES acceptance

All stakeholders have to have consented to the targets: without a well-established political will the support will not be sustained long enough to deliver the expected benefits and results (like cost reduction from learning etc.). The presentations identified the following indispensable elements of the political support:

- long-term and binding development targets, and
- respective long-term legislative projects and planning (e.g. IKEP in Germany)

Developing legal background for RES-E deployment

The presentations were planned to cover the RES status in the different countries from different viewpoints. In the meeting the issues of legal, regulatory and network improvement challenges, price and financial effects were covered. Among the presentations from the EU15 countries there were two that had discussed in details the structural elements of the legal background of RES. They highlighted both the strength and the weaknesses of their national legislation for the RES support. The experiences in Germany and Greece are completely different.

In the design of the legal system Germany could build on the consensus agreed earlier by the political stakeholders. This political agreement created the basis for a sustained renewable energy policy that fostered the unprecedented growth of the sector in Germany.
The initial RES legislation in Greece proved to be insufficient: dozen additional laws, common ministerial and circular decisions etc. were put in place to resolve important processing and technical issues. The regulatory and legislative environment was confusing and extremely bureaucratic, restraining the development of RES in the country. The cap on RES deployment introduced in the former legislation caused lot of problems. The new law of 2006 constitutes the legislative and regulatory framework basis for the initiation of sustainable RES activities in the country. The Feed–in–Tariff sytem that has been introduced includes favourable conditions for grid-connected Photovoltaic (PV) application. One major change in the legal frameworks of Greece concerning PV applications is that new law does not introduce a cap; there is reference to targets expected to be achieved by 2020.

Balancing costs and the reserve capacity requirement

The different solutions to system imbalances caused by the changing electricity output of certain renewable energy production (wind and solar) has been discussed in many presentations. It was the main focus of the presentation on the NordPool experience and of the presentation from the Regional Centre for Energy Policy Research (REKK).

For the NordPool system the effects of large-scale increase of RES-E on the electricity prices is a critical issue. In the Nordpool system the RES electricity share already reached unprecedented levels in the electricity mix and the fulfilment of ambitious plans for the future development which will have major effects on the balancing and reserve system as well as on future price levels.

The NoordPool experience shows that combining wind imbalances with other existing production units (hydro, heat and power etc.) significantly reduces the balancing cost. The smaller the wind proportion is to the other capacities the higher the cost reduction potential of these combinations. The presentation of the Technical Research Centre of Finland (VTT) calculations show that only small change in the use of the existing hydro capacities can cover balance requirements of large scale RE capacities; 80-90 % of of wind power imbalances can be regulated using the existing hydro capacities. Since in the NoordPool region the RES-E share is estimated to expand much further, the balance requirement and the associated costs are considered as a very important part of the future functioning of the electricity market.

The price model (one price model vs. two price model see the presentation on NordPool) used in regulating power imbalances has significant impact on the wind capacities: as long as wind power is not dominating the power system imbalance one-price model is very good for wind power producers since the deviation will be about half and half towards inbalance and balance, there will be no extra cost for the wind capacities.

The presentation discussed the modelling results for RES-E shares and wholesale price effects of the different CO2 prices concluding that the system regulation requirements (balancing and reserves) have negligible effect on the prices compared to the effects that carbon pricing.

Financing reserve capacities: the case for hydro pumping storage

In addition to analysis on the price and balancing effects of a large scale grid integration of wind capacities, in the roundtable the Hungarian co-organising institute (REKK) has also presented a economic analysis of hydro pumping storage as an energy storage option in connection with RES-E integration. The calculations - using the data of Table 1 – suggested that building such system is not very attractive to private investors. Another important conclusion of this research was that the profitability of such investment depends on the price of balancing energy that suppose transparent balancing markets.

Input category	**Unit**	**Value**
Peak off-peak margin	(€/MWh)	20
Overnight cost	(€)	600 000 000
Installed capacity	(MW)	600
Daily production	(MWh)	3 000
Net efficiency	(%)	80%
Yearly production	(MWh)	876 000
Yearly income	(€)	17 520 000
Payback period with 0 discount rate	year	34.2

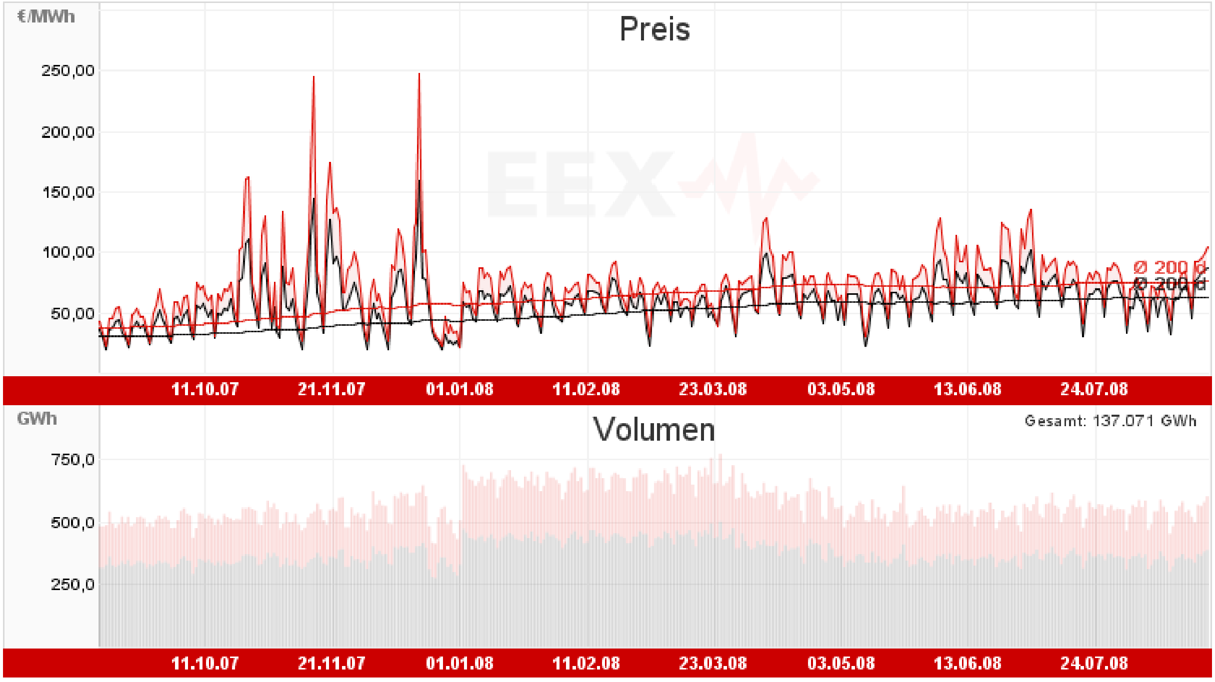
In the roundtable discussion this presentation attracted lot of attention from the participants and stimulated the most intensive discussion. Therefore we invited the speaker to prepare similar analysis on an Austrian example for which the Renewable Energy Unit (REU) has collected some input data (from publicly available information sources for a similar capacity project), in order to facilitate some comparison. The Austrian case study shows the data for a 20 % lower capacity hydro pumping storage. The costs connected to the project is lower than for the other case (with 39%) because it is not a completely new plant but an extension and upgrading of an already existing capacity. The peak off-peak margins (that takes account of the efficiency losses as well) are similar (20 and 22 €/MWh). The projected operation hours and therefore the yearly income are also very similar for the two cases. The analysis did not calculate with O&M costs.

Input category	Value	Source
Installed capacity (MW)	480	Verbund
Overnight cost (€)	365.000.000	Verbund
Operation hours per year (h/a)	2.000	Verbund
Efficiency (%)	80%	own estimation
Off-peak price (€/MWh)	50	EEX
Peak price (€/MWh)	90	EEX
Peak-off-peak margin (€/MWh)	22	
Yearly income (€)	21.120.000	
Payback period with 0 discount rate (year)	17,28	
Payback period with 3 % discount rate (year)	33,97	
Payback period with 5 % discount rate (year)	40,91	

The following conclusions can be derived from the two analyses. The most important conclusion is that the returns to the hydro pumping stations produced by the most recent peak-off-peak margins on the European electricity markets are not adequate to attract investors on pure financial basis. Even if calculated with low expected rate of returns, the pay back time for these type of projects is more than 40 years. We identified four possible factors that can justify the willingness of investors to initiate such projects.

The peak - off peak margins

The peak off peak margins are assumed to be constant in the analysis, however the very recent tendencies show that the peak electricity prices tend to be grow faster, and more volatile than the base load prices. The following EEX figure shows a gradually increasing gap between the peak-load and base-load prices (the red line is the peak-load, the black is the base-load price and their 200 day averages are also shown by the trend lines). More reliable, longer term trend is difficult to establish because of there were structural changes in the electricity markets were organised so the data are often not comparable.



Source:
http://www.eex.com/de/Marktdaten/Handelsdaten/Strom/Stundenkontrakte%20Chart%20%7C%20Spotmarkt%20Stundenauktion/spot-hours-chart/2008-09-01/PHELIX

The effects of regional trade on the benefits

In addition as the hydro pumping power plants can sell electricity abroad (and buy the base-load from domestic sources) so their margins can be much higher as the peak-load base-load price margins experienced on the national exchange. Assuming perfect competition the price difference can be sustained only if there is capacity shortage at the border. The existing price difference is partly due to the existing market imperfections and the capacity shortages. (Table 3).

		Price €/MWh	One month Change (June-July)	Year-to-Year Trend
IPEX	**Base-Load**	**97,32**	**16,6%**	**16,1%**
	Peak	***138,08***	***18,9%***	***2,6%***
	Off-Peak	*66,46*	*8,5%*	*32,3%*
	Holiday	*83,08*	*13,7%*	*32,1%*
EEX	**Base-Load**	**69,94**	**-4,5%**	**138,6%**
	Peak	***92,35***	***-10,7%***	***117,6%***
	Off-Peak	*58,18*	*-2,0%*	*156,6%*
	Holiday	*54,65*	*-4,1%*	*155,9%*
Powernext	**Base-Load**	**70,27**	**-3,5%**	**135,9%**
	Peak	***95,54***	***-12,5%***	***116,0%***

	Off-Peak	*56,30*	*1,9%*	*146,1%*
	Holiday	*54,02*	*-0,2%*	*162,5%*
OMEL	**Base-Load**	**68,19**	**16,9%**	**77,2%**
	Peak	***76,58***	***17,2%***	***59,9%***
	Off-Peak	*61,05*	*16,8%*	*91,5%*
	Holiday	*66,38*	*15,7%*	*89,4%*
NordPool	**Base-Load**	**44,43**	**9,8%**	**151,7%**
	Peak	***50,63***	***-0,6%***	***144,6%***
	Off-Peak	*41,45*	*17,6%*	*154,3%*
	Holiday	*39,81*	*13,3%*	*156,0%*
PME	**Base-Load**	**70,00**	**-4,3%**	**137,8%**
	Peak	***93,14***	***-11,2%***	***116,9%***
	Off-Peak	*57,66*	*-1,0%*	*153,5%*
	Holiday	*54,48*	*-3,0%*	*158,0%*

Table 3 Various prices of European power exchanges
Source: GME’s Newsletter – Issue no. 8 – August 2008

Fees for the auxiliary services

The margins from the peak-load and base-load price difference is not the only source of income for the hydro pumping power plants but they are also paid different fees for the balancing services. On the basis of the operating profits (which derives from the price difference between the peak load and base load price) the investment cost seem to be too high to attract private investors into the sector. Therefore the reserve capacity fee must play an important role in the investment decisions. These payments can also change the cash flow to positive.

The effects of financial structures on RES investment

Quite a few experts touched upon the importance of the financing environment. In the presentation covering the German experiences a very interesting comparison was presented on the possible link between the effectiveness of RES policy measures and the expected profits for wind energy projects (see slide 10. titled "Effectiveness versus expected profit" of the presentation). The tentative conclusion is that effective support can be reached with much lower expected annual profit if the feed-in-tariff type of mechanism is used than in the case of quota type of measures.

The effects of the expected rate of returns

The expected rate of return plays important role in financial decisions not only in the case of the hydro pumping plants but also on how the investors select their power portfolio elements. In this chapter first we show the projections made by European Transmission System Operators on how the increasing wind generation is likely to change the flow and the future production capacities of electricity. A research project was carried out in the REU in 2007 which also projects the capacity changes in Europe due to changing return expectations of the investors. We compare projected capacity changes of ETSO to the results of this financial analysis that assessed the capacity effects of the changing financial structure.

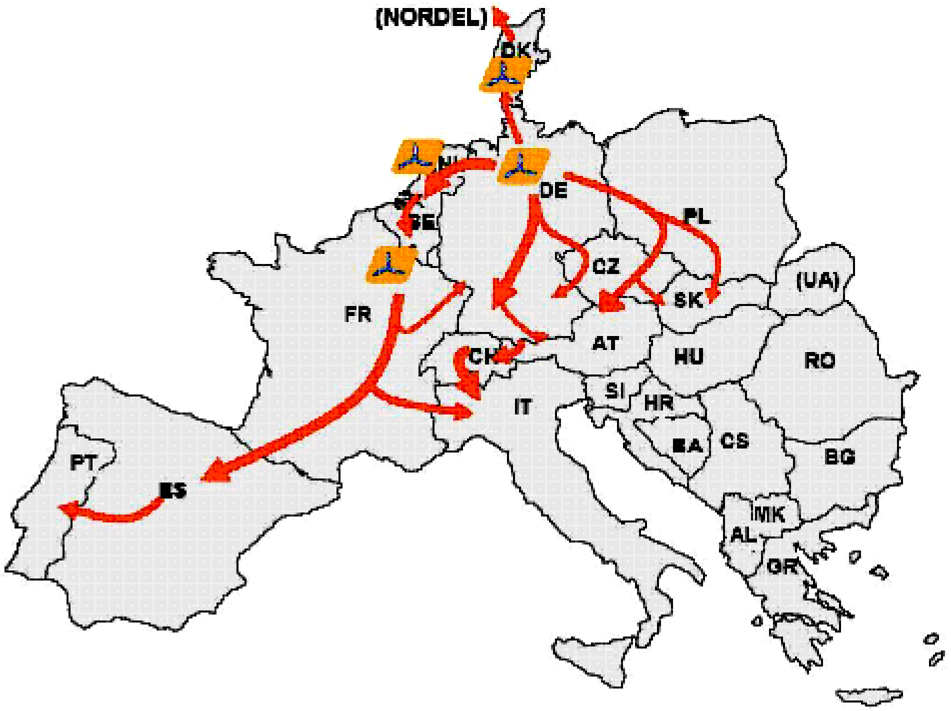


Figure 4 Changes of electrical power transmission in UCTE Scenario North
Source: European Wind Integration Study (EWIS) Towards a Successful Integration of Wind Power into European Electricity Grids European Transmission System Operators http://www.etso-net.org/upload/documents/Final-report-EWIS-phase-I-approved.pdf

The latest investment data shows that Renewable Energy Sources has arrived at a new stage of development worldwide (PV Status Report 2007, 2008, Dexia Bank communication) by moving out of the 'niche market' position they occupied before. This favourable performance is partly due to the booming price of traditional – fossil - fuels and also the improvements of the RES based technologies. These changes will take place throughout Europe so the individual states has to consider effects of the developments on their neighbouring countries even if their decision makers on the electricity sectors are conservative about their potential.
Intensive wind deployment increase in the Northern part of Europe (Denmark, The Netherlands, North Germany) affect practically the electricity flows in Central Europe as well as in Southern countries as far as Portugal (Figure 4,5 and 6). Similar map was drawn for the effects of the Spanish wind development. And these effects are not confined to the national electricity transport infrastructure but also affect through substitution the generation portfolio as well. When the stakeholders in a Member States make the decisions on the future changes of the power production portfolios they have to be aware this substitution effects on the electricity generation capacities of these developments.

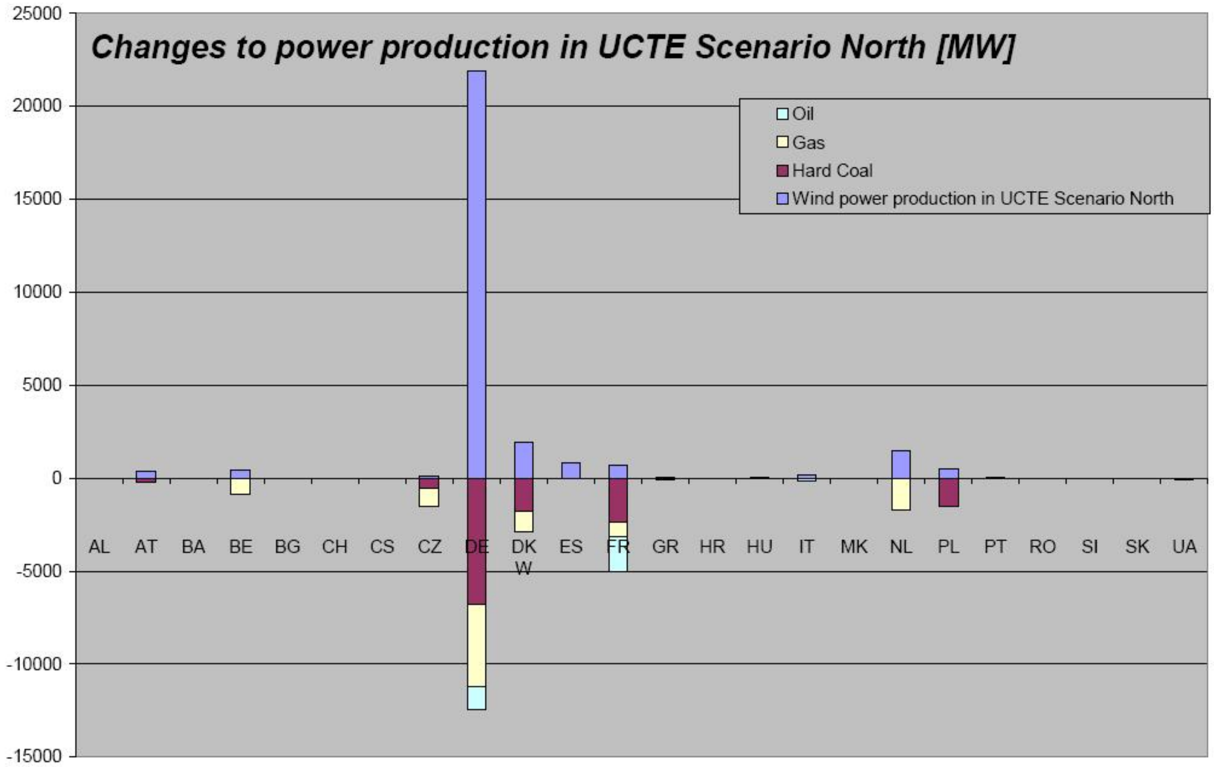


Figure 5. Forecast for power production changes due to the Northern wind development (see source reference in Figure 4)

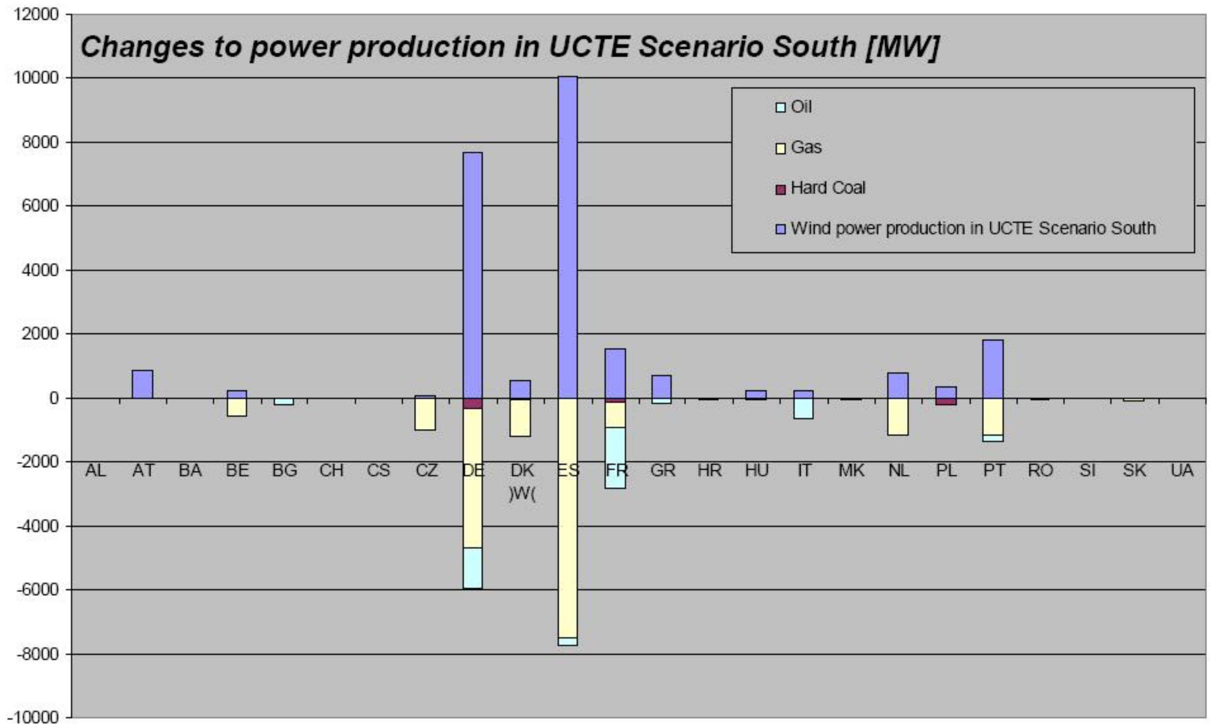


Figure 6. Forecast for power production changes due to the Southern wind development (see source reference in Figure 4)

A research project carried out in the REU in 2007 projects similar capacity changes due to changing relative paybacks (see Figure 7).

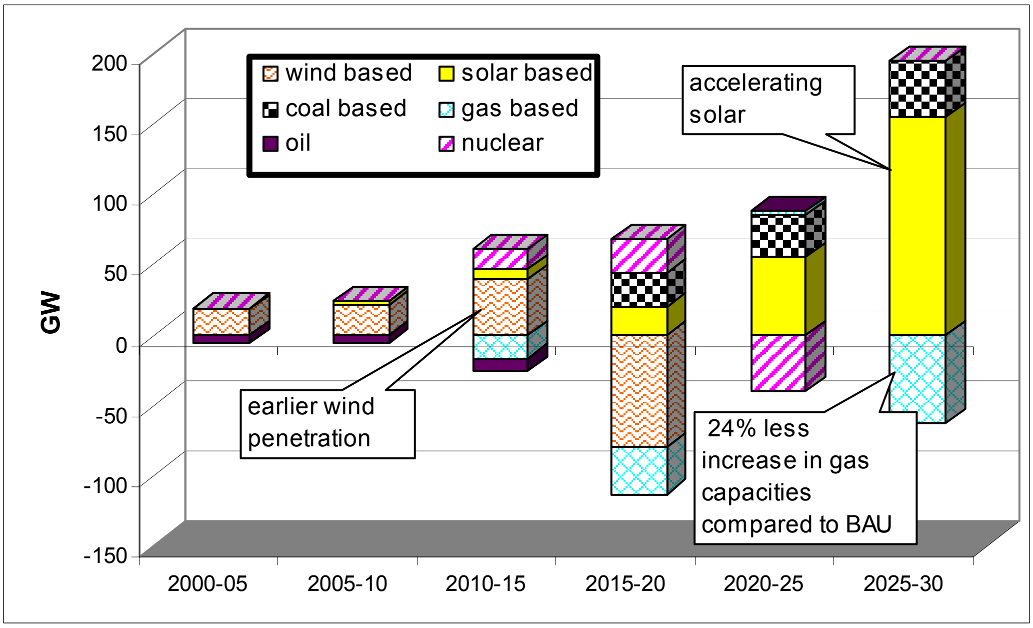


Figure 7 Projected electricity generation portfolio per technology
Source: Szabo, S. – Jaeger-Waldau, A.: More competition: Threat or chance for financing renewable electricity? In Energy policy, Vol. 36 Issue 4. 2008 pp. 1436-1448

The effects on the overall European electricity generation mix are summarised in Figure 8 that show the changes in the capacities and utilisation of the various portfolio elements. The first graph shows the historic portfolio, the second shows the projected 2030 portfolio under two different return expectations. Scenario B (business-as-usual) calculates with the sustained high return expectations that prevail today in Europe to result in the slowdown of RES technology deployment. The historical return-on-investment (ROI) data used to approximate the expected rate reveals a huge gap between the European and other OECD countries (USA; Japan, Australia) in this respect (Figure 9). In Scenario B gas based capacity increase would crowd out almost entirely the traditional sources (oil, coal, nuclear). In contrast, in the competitive finance scenario (Scenario C) suppose that the expected rate of returns decreases to the level closer to the current US one, part of the substitution would be borne by wind, biomass and later by solar technologies. The dominance of gas technology will be still apparent but more limited.

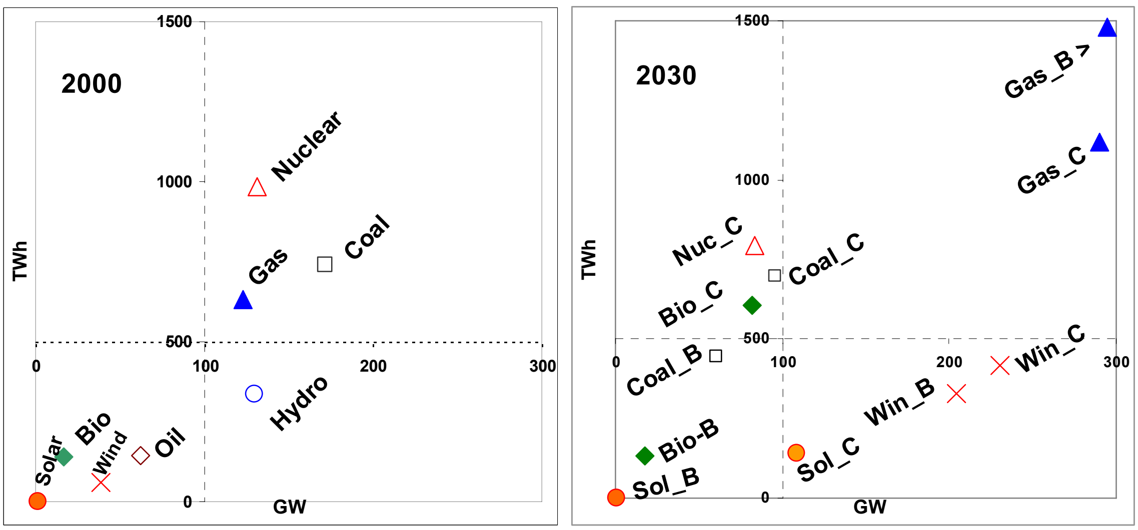


Figure 8 Projected electricity generation portfolio per technology
(see source reference in Figure 7)

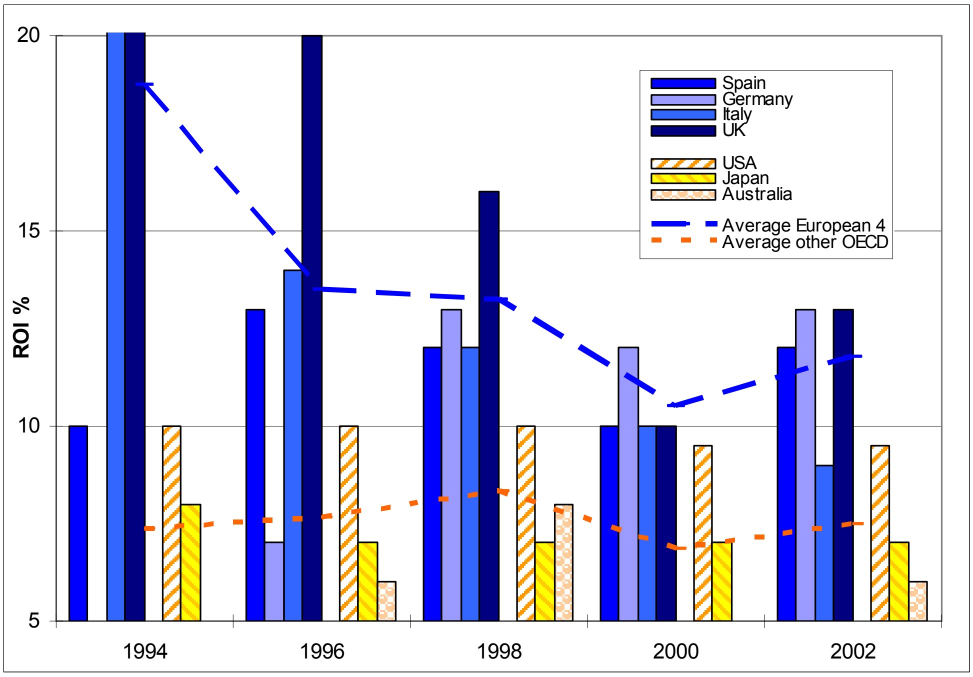


Figure 9 ROI disparity between Europe and other OECD countries
(Source: International Energy Agency 2003)

Both Scenarios assume that learning takes place over time but suggests different cost reduction potential for the various technologies (Figure 10). There are technologies like gas turbines for which the steep cost reduction phase has already taken place, so only lower learning rate can be achieved with the capacity increase. The photovoltaic (PV) technology however can still be characterised by the steep learning potential.

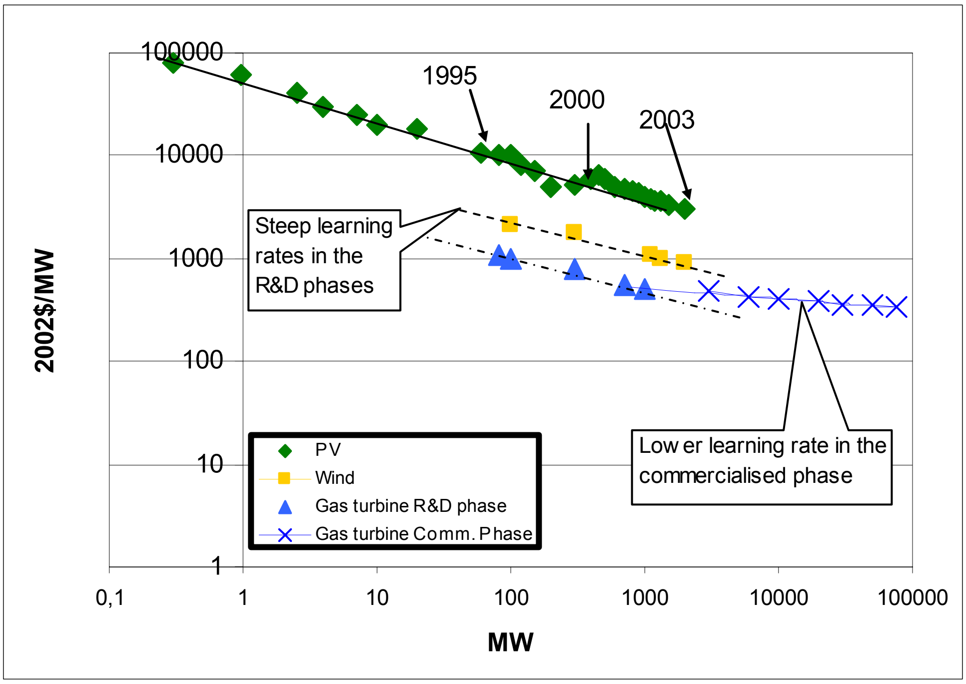


Figure 10 Learning curves for the various technologies
(Source: Gritsevskyi, A – Nakicenovic, N, 2000)

Using geographically differentiated input parameters for the four regions of Europe (Western Europe, Noordpool, CENTREL and Mediterranean countries) also revealed some remarkable results on the regional portfolios. The higher financial costs in the CENTREL countries (because of the additional risk premiums applied to these countries) together with the initial portfolio mix can result in slower rate of RES-E development in the CENTREL region (Figure 11). It can have serious implication on how to achieve a harmonised European policy on RES deployment.

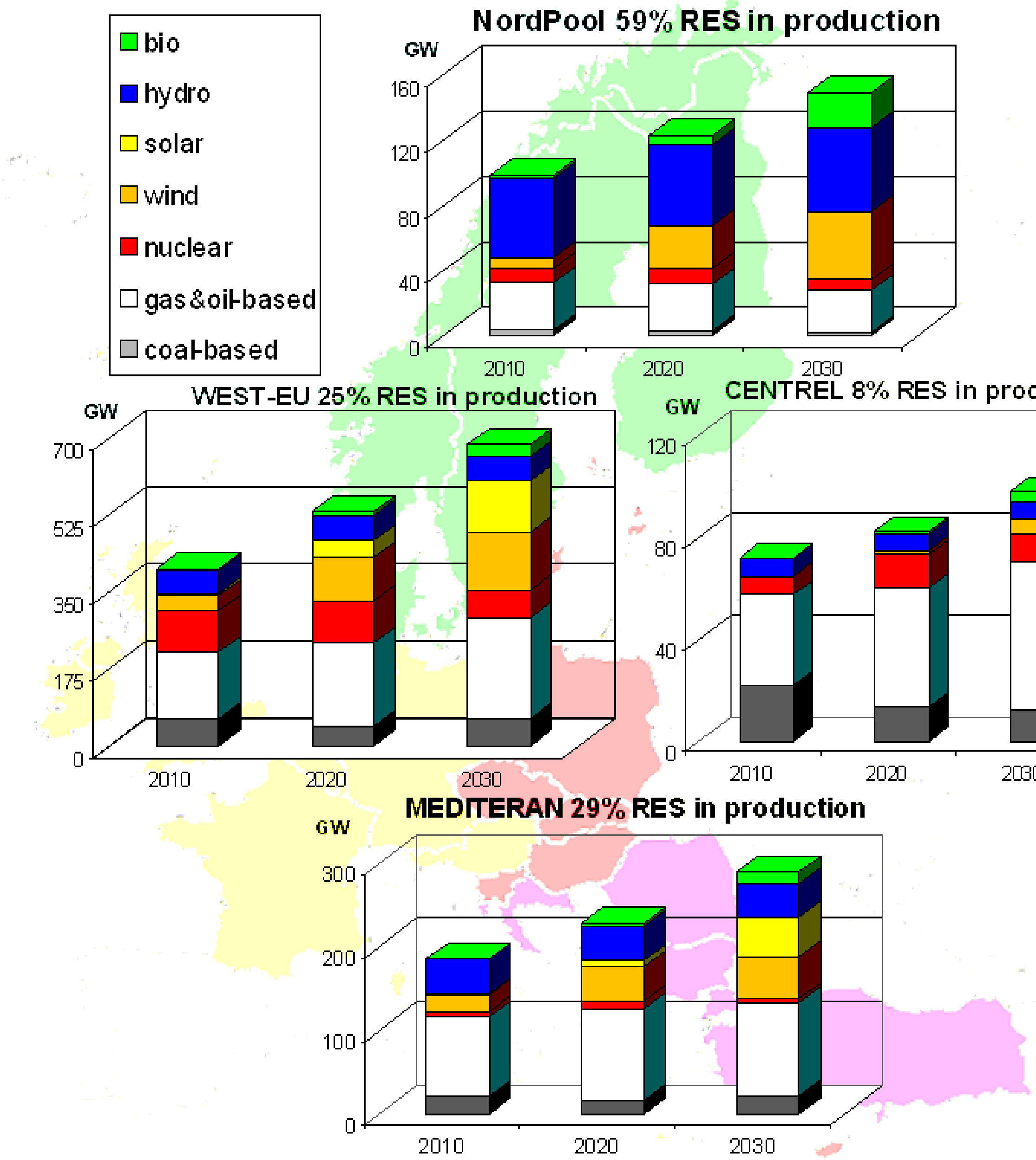


Figure 11 RES-E deployment in the various regions of Europe (the % are for 2030) (see source reference in Figure 7)

Feed-back on the proposed questionnaire

An expert survey was designed in the REU with the objective to identify the areas/focus points of the policy discussion among decision makers in the renewable energy field.
As the official statistics and the country presentations of the present proceeding show the EU member states have achieved very different level of RES presentation in their electricity generation portfolios. These differences are pointed out not only in the absolute levels of RES penetrations, but also in attained levels relative to the national targets. The expert discussion showed that while the regional differences of the resource potential explains some of the differences between the regional penetrations, the key factor to explain the lower penetration of RES into the electricity generation

portfolio is more **perceptional** problem of the various stakeholders than physical or technical barriers. Obviously these technical barriers do exist in the countries but the positive examples from some Member States show that these can be overcome without entailing excessive costs to the system. When these technical changes are designed carefully these even can decrease the losses. The questionnaire discussed in the roundtable was designed to point out and measure the above mentioned perceptional differences among the stakeholders.

The expert survey will identify those statements which are agreed by all stakeholders to be top priority, and also those that principally divide them. The identification of the gap between the stakeholder groups may help in the further refinement of the already accepted policies and targets.

We have categorized the stakeholders into the following groups:

- Regulator/Government
- TSO/Distribution
- Investor
- Research Institute

We will also analyse whether the preferences are significantly differ in the various geographical areas:

- EU 15
- EU 12
- Candidate countries.

We initiated this expert survey because already a small number of answers from a balanced group of stakeholders can result in a meaningful picture of the strategic discussion. The answers of the expert are treated anonymously. In the result we will refer only to the group/stakeholder categories mentioned above. There was a noticeable disagreement among the experts who should pay for the grid connection and for the necessary network upgrades. This issue is addressed in the questionnaire. We had made the changes proposed by the participants of the roundtable and the questionnaires are being sent out to the experts. The result will be communicated when sufficient number of filled in questionnaire will be sent beck and analysed.

Related EU projects

The stakeholders' growing interest is also shown by the growing number of conferences connected to the topic (Renewable Energy: Grid Integration Summit on the 24-25th June 2008 London, energy generators, project developers and grid operators view; Smart Electric Power Distribution Summit 21-22 April Amsterdam).

A number of electricity projects were carried out within the 6th Framework Programme of the European Commission in connection with RES integration. One can find further information on them in the publication titled "European Electricity Projects 2002 – 2006" (available online on the following link: http://ec.europa.eu/research/energy/pdf/synopses_electricity_en.pdf)
Among them there are two that have to be mentioned, because of the close relation of their topics.

Enhancement of sustainable electricity supply through improvements of the regulatory framework of the distribution network for distributed generation (DG-GRID)

The DG-GRID project is aimed at a better deployment of distributed generation (renewables, CHP and other small generation) by improving the coordination between distributed generation (DG) and the electricity distribution network. Improved coordination can be realised by a more adequate framework that regulates the distribution network operators business and determines regulatory arrangements between DG and electricity distribution networks. New innovative approaches in network planning and operations will provide opportunities for larger DG deployment at relatively low costs. Based on several studies, the DG-GRID project will develop guidelines for improved regulation, network planning and the enhancement of integration of DG in the electricity supply system in both the short and long term. Improvement of regulatory arrangements between distributed generation and the electricity distribution network

Benefits: Larger deployment of distributed generation at lower costs and secured reliable electricity supply

Expected and/or achieved results

- Review of the current electricity network regulation in 15 EU Member States.
- Analysis of possible innovations and long-term development of electricity grids.
- Assessment of the costs and benefits for the electricity network in the case of large penetration of DG.
- Analysis of new regulatory arrangements for economically viable grid system operations by operators of the electricity distribution grids.

Solid-Der

The SOLID-DER Sixth Framework project has been set up to specifically assess the economic, policy and regulatory drivers and barriers influencing the further integration of Distributed Energy Resources (DER) in the electricity supply system of the new Member States (NMS) and Candidate Countries of Central and Eastern Europe.

The integration of DER in the European electricity networks has become a key issue for energy producers, network operators, policy makers and the R&D community. In some countries it created already a number of challenges for the stability of the electricity supply system, thereby creating new barriers for further expansion of the share of DER in supply.

On the other hand in many Member States there exists still a lack of awareness and understanding of the possible benefits and role of DER in the electricity system, while environmental goals and security of supply issues ask more and more for solutions that DER could provide in the future.

The project SOLID-DER, a Coordination Action, will assess the barriers for further integration of DER, overcome both the lack of awareness of benefits of DER solutions and fragmentation in EU R&D results by consolidating all European DER research activities and report on its common findings.

In particular awareness of DER solutions and benefits will be raised in the new Member States, thereby addressing their specific issues and barriers and incorporate them in the existing EU DER R&D community.

Barriers and recommendations identified by the project

When comparing the barriers to increasing DER shares into the electricity network in the old and new Member States, we can conclude that they are quite similar. Main barriers identified are:

- Lengthy and complicated administrative procedures, by investors in DER power plants in many countries often considered as the most severe barrier.
- Dominant position of DSOs in negotiating network access in combination with non-transparent connection procedures.

- Unstable support mechanisms making it difficult to plan long-term projects. This is a barrier that is more seriously considered in the new Member States where support for DER has been introduced very recently only.
- Lack of knowledge about advantages of DER generated power leading to opposition of local communities to new DER projects.

Annex 1: Workshop participants

Jorge Vasconcelos	Director of European Renewable Energy Investment Portfolio; Former President Council of European Energy Regulators	Renewable energy: new challenges for regulators and network operators	Portugal/ Spain
István Pataki	Vice President of Hungarian Energy Office	The new RES regulation: the Green Package in Hungary	Hungary
Harry Lehmann	Federal Environmental Agency Environmental Planning and Sustainable Strategies	Necessary policy elements to overcome barriers that prevent the integration of RES-E	Germany
Christos Protogeropoulos	RENI	New Legislative and Regulatory Measures for the Development of RES Technologies & Applications in Greece and Experiences Encountered after Two Years of Programme Activity	Greece
Göran Koreneff	Technical Research Centre of Finland (VTT)	Effects of large-scale increase of RES-E with the focus on the spot market price levels in the Nordic Power system	NordPool/ Finland
Tamás Tóth	Hungarian Energy Office Economic Analyst	Specific economic details of the RES regulation (penalties for wind generators due to production outside the schedule)	Hungary
András Mezősi	Regional Centre for Energy Policy Research	Economic analysis of energy storage requirements in connection with RES-E	Hungary
Vaida Tamašauskaitė	Energy Development Department Lietuvos energija AB (TSO)	Wind Projects integration in Lithuanian Electricity Network	Lithuania
Vaclavas Kveselis	Head of Laboratory of Regional Energy Development Lithuanian Energy Institute	Renewable Energy Sources for electricity production: status in Lithuania	Lithuania
Hanna Bartoszewicz-Burczy	IEN Poland	Renewable Energy Sources in Poland–Evolution, Current State and Possibilities of evelopment	Poland
Dan Teodoreanu	Research Institute for Electrical Engineering (ICPE)	The Renewable Energy Sources in Romania – Elements of the proposed RES legislation	Romania
Corneliu Radulescu	ARCE- Romanian Agency for Energy Conservation	Renewable Energy Sources and Energy Efficiency in Romania in the light of the EU legislation	Romania
Rostislav Krejcar	Head of Generation and Network Regulation Unit Electricity Department Energy regulatory office ERU	The latest issues with RES-E development in the Czech Republic	Czech Republic
Péter Kaderják	REKK		Hungary
Zsuzsanna Pató	REKK		Hungary

Borbála Tóth	REKK		Hungary
András Mezsi	REKK		Hungary
Arnulf Jaeger Waldau	JRC		EC
Tamás Horváth	JRC		EC
Sándor Szabó	JRC		EC

Annex 2: The list of statements of the expert survey

Resources, security of supply		1) The New Member States of the EU (NMS, countries that joined the EU after 2004) countries have less endowments for renewable energy than that of the old member states.
		2) Higher RES (Renewable Energy Sources) mean more secure electricity system.
		3) If we assume that the information on the renewable potentials is less reliable for the NMS, then NMS targets must be based on the lower bound of these estimates.
		4) As members states have very different levels of RES penetration, target setting should be based on the technically achievable RES option rather than on absolute target levels
		5) Due to the higher fossil fuel prices the RES-E options become more favourable in the merit order of electricity generation.
Costs		6) As the various RES technologies have different costs, countries with lower potentials in the less expensive options should be compensated by differentiating the target (in level or timing).
		7) Differentiating RES targets by member states have higher transaction costs (e.g. controllability, negotiation costs) than the overall gains.
		8) In CEE the financing costs are higher. The financing institutions have risk premiums and higher return expectations in the region that adds on the financing costs.
		9) When there is a high proportion of nuclear there is less extent for the less flexible/adjustable generation therefore the integration of RES is more expensive.
		10) The co-generation and RES-E has to be clearly distinguished in order to prevent giving financial support to activities that would be profitable on their own.
		11) The upgrade of system and network that is necessary due to the RES integration should be financed exclusively by the RES companies not to be spread over to all the consumers.
		12) There are high external costs associated to the fossil fuel sources. Supporting RES up to the level of these externalities always pay back.
		13) Undifferentiated support is an efficient tool for supporting RES: it gives a proper indication/incentive to invest in the cheapest RES sources.
Regional cooperation, market		14) NMS countries do not act as suppliers for the renewable technologies, so they are disadvantaged compared to the EU15.
		15) Improving regional integration or deeper cooperation of the electricity systems will play a vital role in the achievement of higher share of RES-E (e.g. adjustable power plants or storage in one country could be used to integrate more intermittent RE sources in another).
		16) The small size of a given market is a barrier to RES-E.

		17) The non-existence of liquid wholesale electricity markets blocks the integration of higher shares of RES into the electricity portfolio.
		18) Both electricity supply and demand are variable. The issue, therefore, is not one of variability or intermittency per se, but how to predict, manage and ameliorate variability and what tools can be utilised to improve efficiency.
		19) The shortage of cross-border transmission links prevents the new producers, including RES producers as well, from entering the markets.
		20) The existence of dominant, vertically integrated power companies create barriers to the RES because it can increase the cost of entrance to prohibitive levels.
		21) Technological Learning through increasing production can make RES significant portfolio element in electricity generation.
Network upgrade		22) The capacity of the European power systems to absorb significant amounts of wind power is determined more by economics and regulatory rules than by technical or practical constraints.
		23) Irrespective of whatever policy is chosen by the EU, massive investments in generation plants and grids are required.
		24) The new power developments in RES and other distributed generation require a new grid infrastructure.
		25) The third party access rules to the new grid lines play important part in the market access as well as boosting investment in developing the infrastructure.
System services		26) The increasing share of distributed generation has to be taken into account in the system level requirements (primary/secondary/tercier reserves, stability).
		27) In NMS there is an already existing but untapped system reserve capacity that could be utilised with the regulation and if proper incentive system would be put in place.

Necessary policy elements to overcome barriers that prevent the integration of RES-E

Dr. Harry Lehmann
German Federal Environmental Agency (UBA)

- **German RES-E deployment, ...**
- **... important boundary conditions and**
- **... economic impacts and effects**
- **RES in Germany – yesterday and tomorrow**

Benefits of using renewable energies

- Climate protection
- Independence of fossil fuel imports
- Reduction of (international) conflicts
- Low risks for humans and environment
- Local economic and social development especially for poor countries
- Fostering industrial development and export opportunities

RES promotion should harvest all benefits

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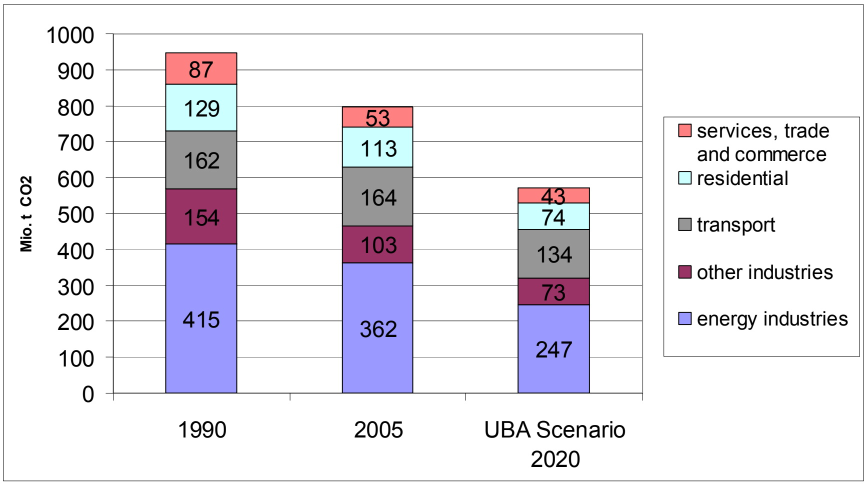
Für Mensch und Umwelt

Necessary policy elements to overcome barriers that prevent the integration of RES-E

UBA Scenario - 2020 - German CO2 Emissions



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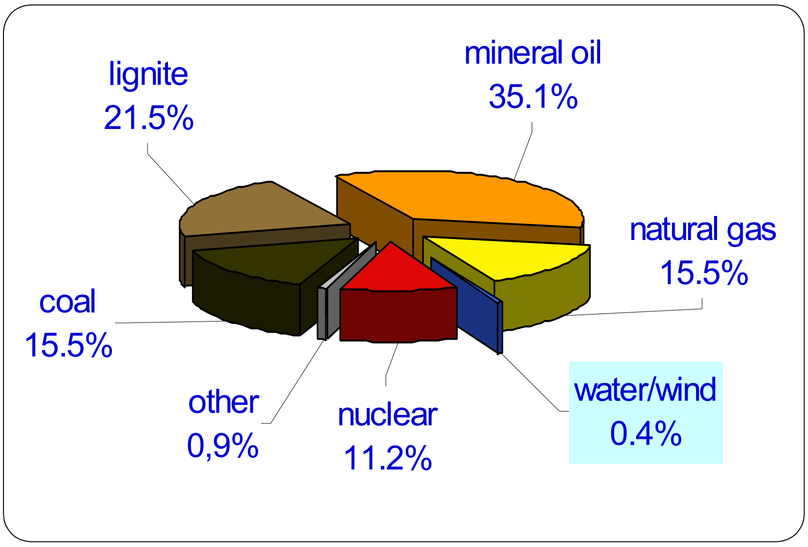
Necessary policy elements to overcome barriers that prevent the integration of RES-E

Structure of PEC in Germany 1990



Source: BMU

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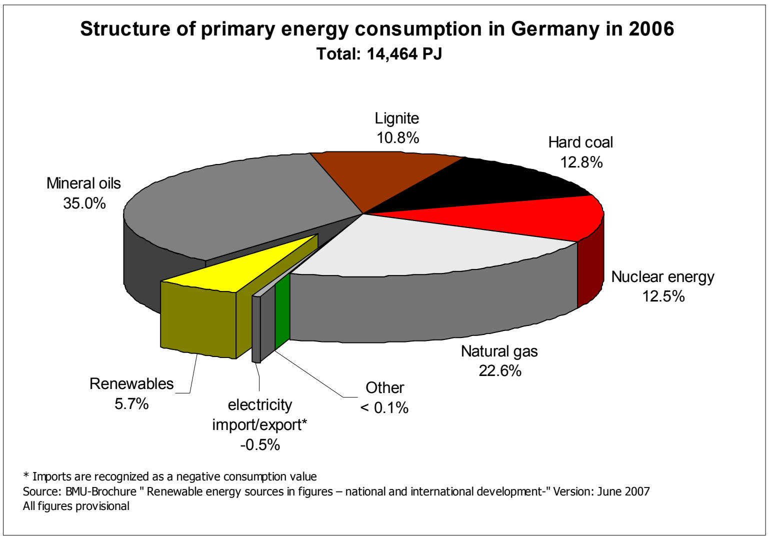
Necessary policy elements to overcome barriers that prevent the integration of RES-E

Structure of PEC in Germany 2006



Source: BMU

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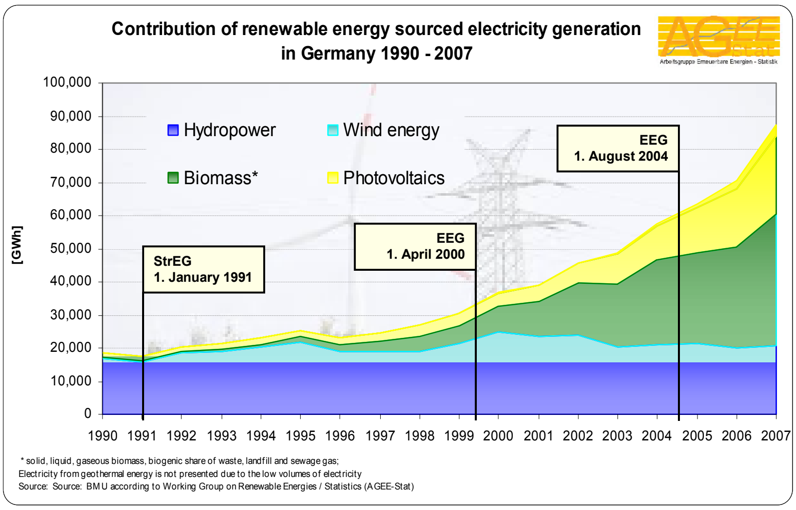
Necessary policy elements to overcome barriers that prevent the integration of RES-E

Development of RES-E in Germany
1990 - 2007



Source: BMU

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Necessary policy elements to overcome barriers that prevent the integration of RES-E

Renewable Energy Sources Act – EEG
basic and necessary features

- **priority connection of installations**
- **priority purchase and distribution of electricity**
- **guaranteed feed-in tariffs**
  - covering extra technology cost and sufficient profit
  - support timeframe long enough to ensure investment security
  - decrease over time (for new installations) enforces cost reduction
- **independence of public budgets – low transfer costs**
  - nation-wide proportional distribution of electricity purchased and corresponding fees to all electricity customers ("EEG-Quota")
  - EEG defines a legal relationship between private bodies
- **"Exclusive-use" principle**
- **Experience and Impact Report to German Parliament**

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Necessary policy elements to overcome barriers that prevent the integration of RES-E

Important boundary conditions

- **Well-established political will**
  - long-term and binding development targets
  - respective long-term legislative projects und planning (e.g. IKEP)
- **Grid access conditions**
  - Germany's EEG, Energy Economics Act, Federal Net Agency
- **Spatial and community planning processes**
  - provision of specific areas and conditions with "national interest"
  - privileged projects in non-constructed community areas
- **Effectiveness of plant authorization**
  - one-stop authorization including all partial licenses
  - clear license conditions with limited lead time
- **others**
  - sustainability (that's understood !?)
  - public awareness and participation
  - Research (at the right time)
  - Training (all levels)
  - community profit-sharing
  - …

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Necessary policy elements to overcome barriers that prevent the integration of RES-E

Renewable Energy Sources Act – goals

General
- climate and environmental protection,
- sustainable energy system,
- integration of external cost
- fostering of technology development

share of RES-E on electricity use

§1 EEG 2000
- substantial increase of RES-E
  (foster the German RES deployment goals)

§1 EEG 2004
- until 2010: increase to at least 12.5% of electricity consumption
- until 2020: increase to at least 20% of electricity consumption

§1 EEG 2009
- until 2020: increase to at least 25 to 30% of electricity consumption
- continuous further increase

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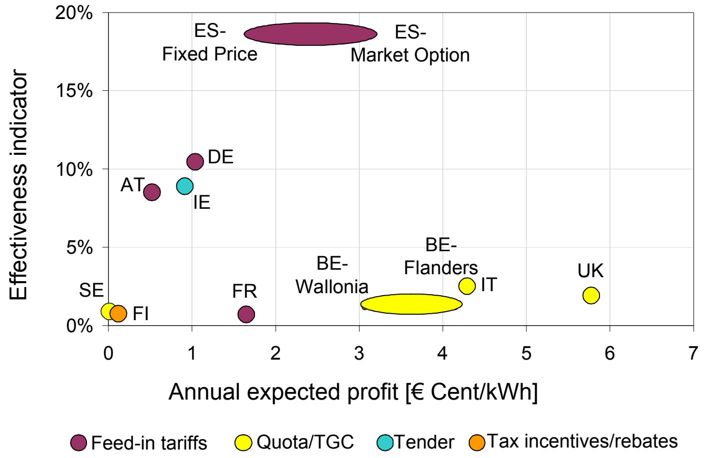
Effectiveness versus expected profit
wind energy - 2004



Source: Fraunhofer Institute Systems and Innovation Research

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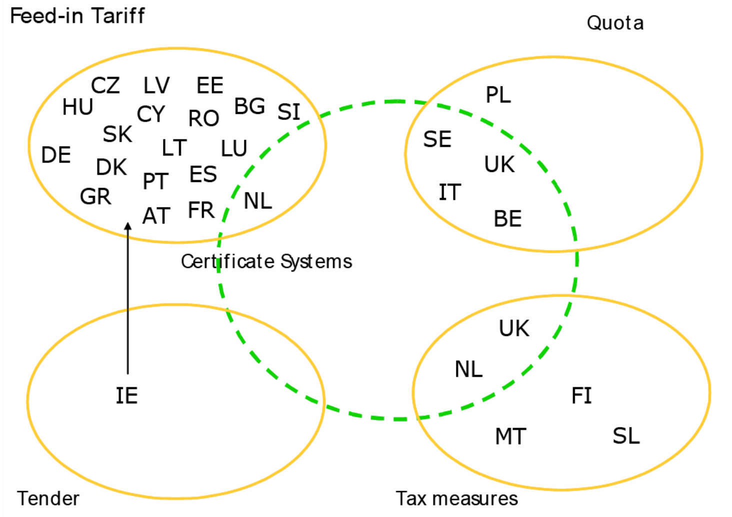
Necessary policy elements to overcome barriers that prevent the integration of RES-E

Policies for RES support – EU27



Source: Fraunhofer Institute Systems and Innovation Research

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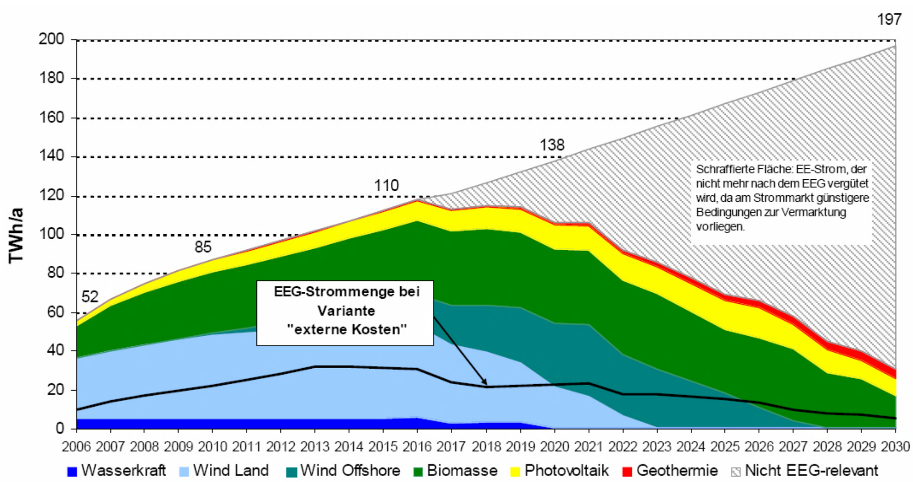
Necessary policy elements to overcome barriers that prevent the integration of RES-E

EEG_{2009}-supported RES-E - forecast



Source: BMU

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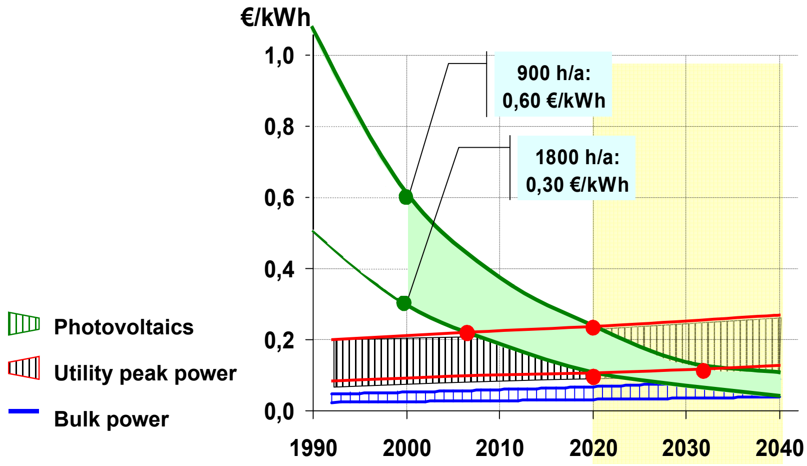
Necessary policy elements to overcome barriers that prevent the integration of RES-E

PV-electricity generation costs and market price



Quelle:
RWE Energie AG and RSS GmbH

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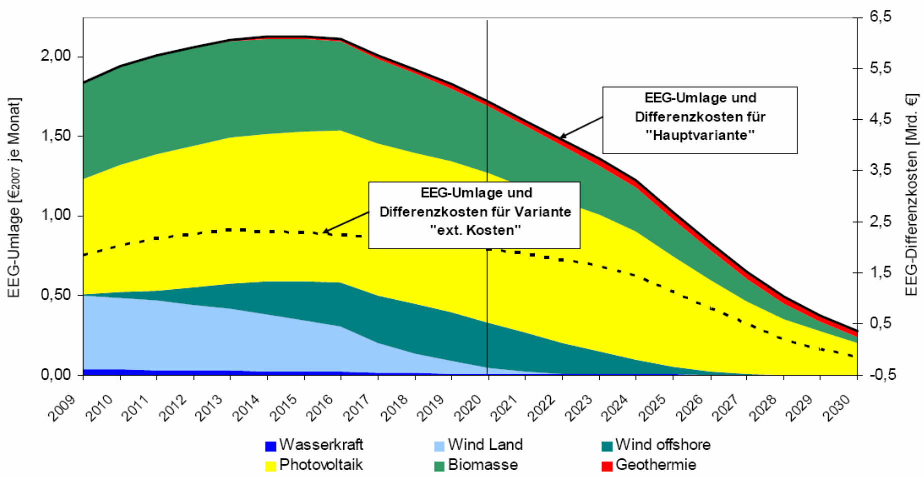
Necessary policy elements to overcome barriers that prevent the integration of RES-E

EEG_{2009}-monthly cost/consumer – forecast



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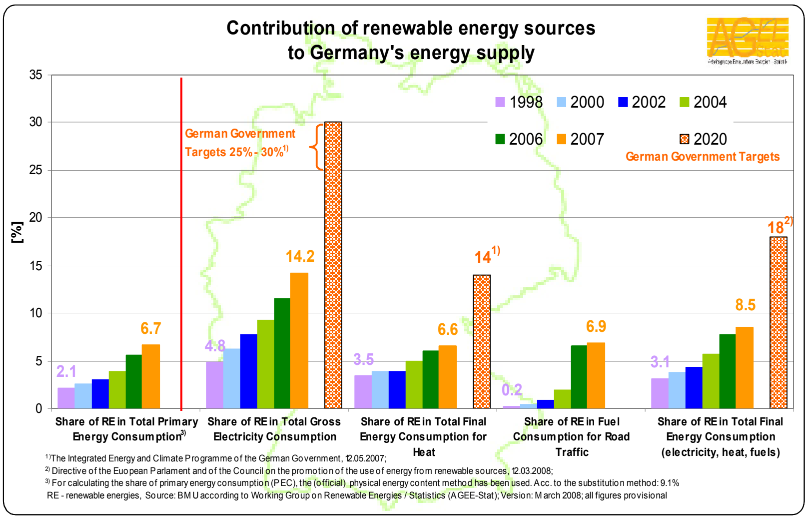
Necessary policy elements to overcome barriers that prevent the integration of RES-E

Renewable Energy Shares in Germany



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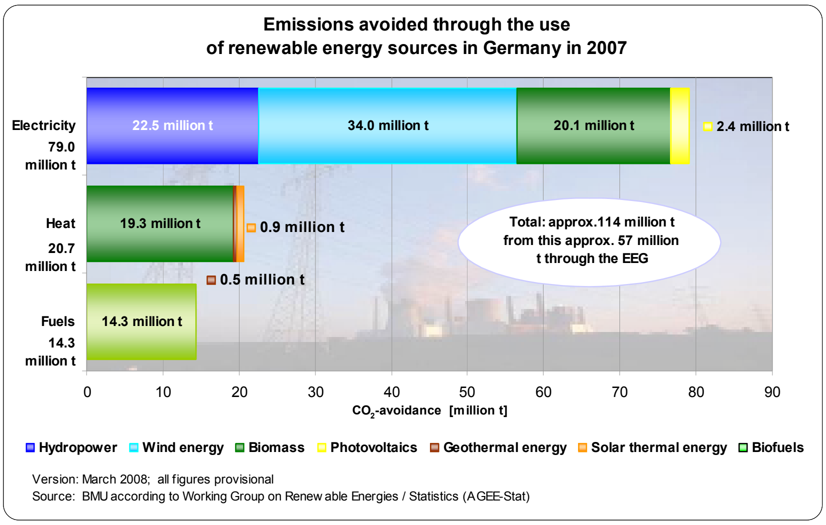
Necessary policy elements to overcome barriers that prevent the integration of RES-E

CO2-emission avoided by the use of RES
2007



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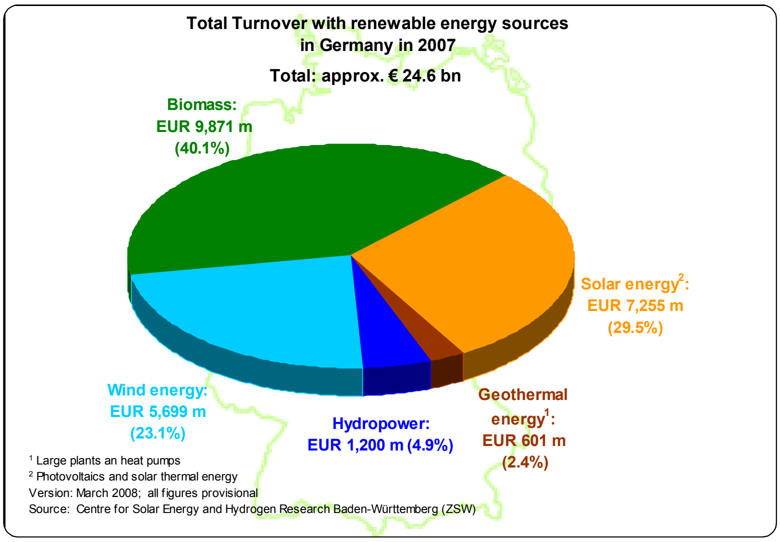
Necessary policy elements to overcome barriers that prevent the integration of RES-E

Turnover related to RES use – total



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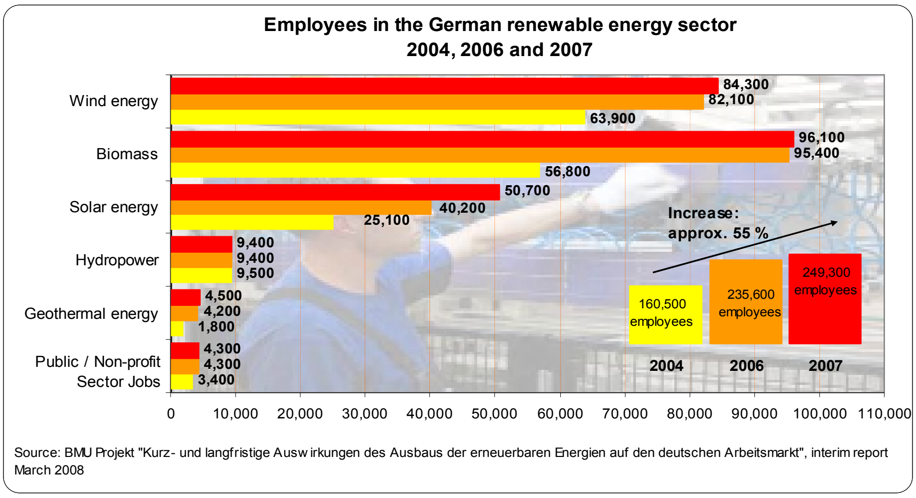
Necessary policy elements to overcome barriers that prevent the integration of RES-E

Employment related to Renewable Energy use



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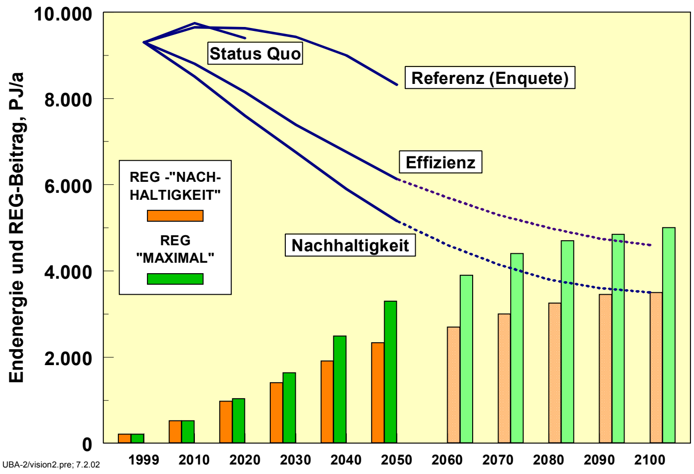
Necessary policy elements to overcome barriers that prevent the integration of RES-E

UBA Long Term Scenarios

Langfristige Entwicklungstendenzen von REN und REG



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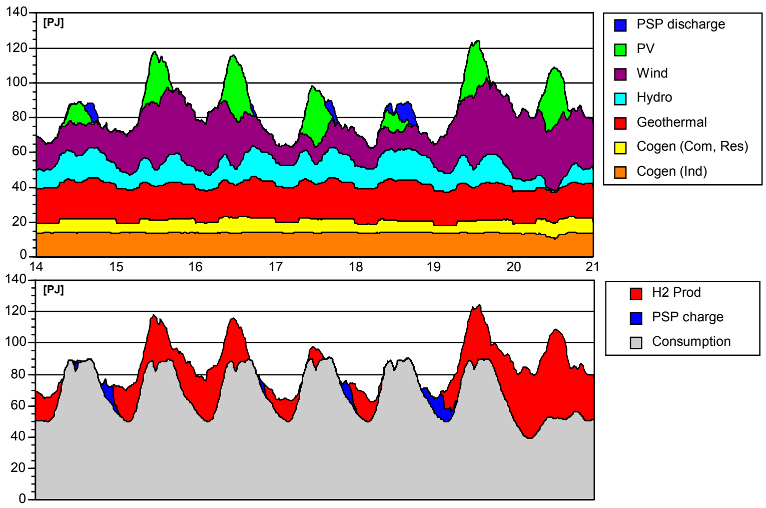
Necessary policy elements to overcome barriers that prevent the integration of RES-E

OECD Country 100% - Electricity system



Source: ERJ, info@energyrichjapan.info

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Necessary policy elements to overcome barriers that prevent the integration of RES-E

Necessary policy elements to overcome barriers that prevent the integration of RES-E

Dr. Harry Lehmann
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- German RES-E deployment, ...
- ... important boundary conditions and
- ... economic impacts and effects
- RES in Germany – yesterday and tomorrow

Thank your for your attention !

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RENEWABLE ENERGY:

NEW CHALLENGES FOR

REGULATORS AND NETWORK

OPERATORS

Jorge Vasconcelos

NEWES, New Energy Solutions

INTEGRATION OF MORE RENEWABLE ELECTRICITY IN THE CEE REGION: NETWORK OR SUPPORT PROBLEM?

Budapest, Corvinus University

May 20, 2008

RENEWABLE ENERGY : NEW CHALLENGES FOR REGULATORS AND NETWORK OPERATORS

1. INTRODUCTION

RENEWABLE ENERGY IN CONTEXT

- ENERGY AND CLIMATE CHANGE POLICY
- SECURITY OF SUPPLY

EU ENERGY POLICY

"Given that energy production and use are the main sources for greenhouse gas emissions, an integrated approach to climate and energy policy is needed to realise this objective. Integration should be achieved in a mutually supportive way."

European Council, March 2007

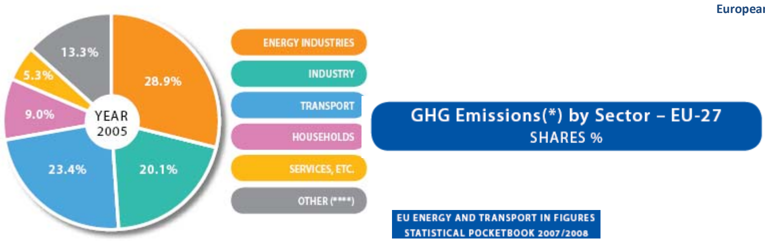
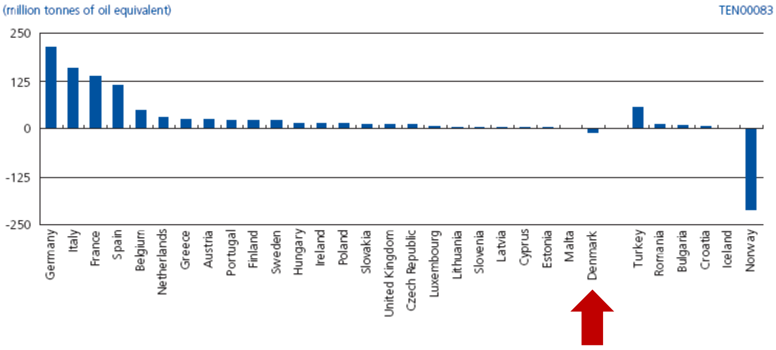


Figure SP.5: Net imports of energy, 2004 (1)
(million tonnes of oil equivalent)



EUROPE IN FIGURES — Eurostat yearbook 2006-07

Share of Renewables to final (*)
ENERGY CONSUMPTION WITH NORMALISED HYDRO

	2000	2001	2002	2003	2004	2005
EU-27	7.6%	7.6%	7.9%	7.9%	8.1%	8.5%
EU-25	7.4%	7.4%	7.7%	7.7%	7.9%	8.3%
BE	1.2%	1.3%	1.4%	1.6%	1.8%	2.2%
BG	8.2%	8.1%	9.0%	8.8%	9.4%	9.4%
CZ	2.4%	2.7%	2.9%	4.3%	5.9%	6.1%
DK	11.7%	12.3%	13.4%	14.9%	16.1%	17.0%
DE	4.0%	4.2%	4.8%	4.6%	4.7%	5.8%
EE	16.0%	15.3%	14.9%	14.9%	19.0%	18.0%
IE	2.2%	2.3%	2.3%	2.4%	2.7%	3.1%
EL	7.4%	7.3%	7.2%	6.8%	6.8%	6.9%
ES	8.3%	8.2%	8.3%	8.6%	8.5%	8.7%
FR	10.6%	10.4%	10.3%	10.3%	10.1%	10.3%
IT	4.8%	4.9%	5.5%	4.7%	5.0%	5.2%
CY	2.6%	2.5%	2.5%	2.4%	2.6%	2.9%
LV	35.5%	34.8%	34.4%	33.6%	34.8%	34.9%
LT	16.7%	16.8%	16.8%	16.9%	15.4%	15.0%
LU	0.9%	0.8%	0.7%	0.8%	0.9%	0.9%
HU	2.8%	2.6%	4.8%	4.7%	4.4%	4.3%
MT	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
NL	1.6%	1.6%	1.6%	1.8%	2.0%	2.4%
AT	25.6%	25.4%	24.7%	23.8%	22.8%	23.3%
PL	6.5%	6.9%	7.2%	7.1%	7.1%	7.2%
PT	19.6%	19.2%	19.4%	19.5%	18.3%	20.5%
RO	16.9%	14.0%	14.8%	16.3%	16.3%	17.8%
SI	16.4%	16.2%	16.7%	16.4%	16.2%	16.0%
SK	3.2%	5.7%	5.1%	5.8%	6.3%	6.7%
FI	29.0%	28.0%	28.5%	28.0%	29.2%	28.5%
SE	37.4%	37.2%	36.5%	37.3%	38.2%	39.8%
UK	0.9%	0.9%	1.0%	1.1%	1.2%	1.3%

EU ENERGY AND TRANSPORT IN FIGURES
STATISTICAL POCKETBOOK 2007/2008

2. RENEWABLE ENERGY IN THE EU

- ENERGY PRODUCTION
- GROSS INLAND ENERGY CONSUMPTION
- ELECTRICITY GENERATION (2005 ... 2020)

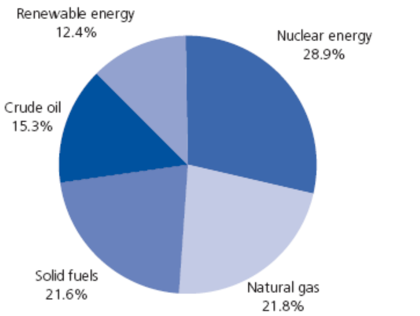


Figure SP.1: Production of primary energy, EU-25, 2004
(% of total, based on 1 000 tonnes of oil equivalent)

EUROPE IN FIGURES — Eurostat yearbook 2006-07

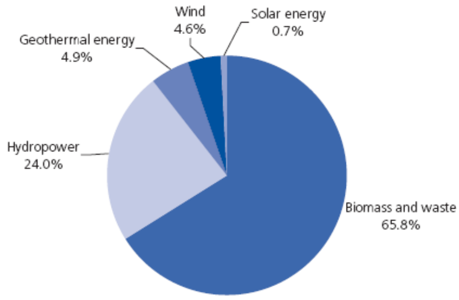
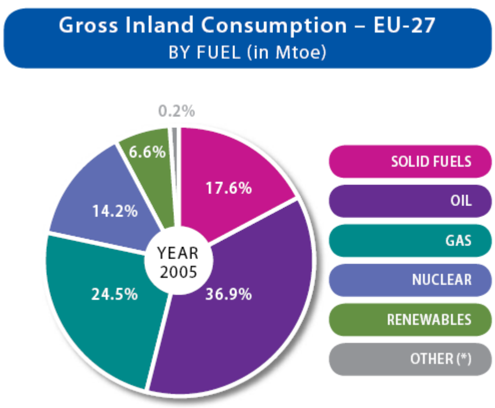


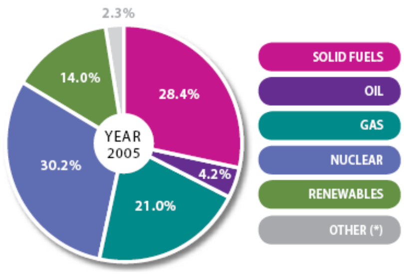
Figure SP.3: Primary production of renewable energy, EU-25, 2004
(% of total, based on 1 000 tonnes of oil equivalent)

EUROPE IN FIGURES — Eurostat yearbook 2006-07



EU ENERGY AND TRANSPORT IN FIGURES
STATISTICAL POCKETBOOK 2007/2008

GROSS ELECTRICITY GENERATION – EU-27
(in TWh)



EU ENERGY AND TRANSPORT IN FIGURES
STATISTICAL POCKETBOOK 2007/2008

Gross Electricity Generation
FROM RENEWABLES, 2005 (in GWh)

	RENEWABLES	Hydro (*)	Wind	Biomass	Solar (**)	Geothermal
EU-27	464 379	306 970	70 482	80 042	1 490	5 395
Share	100.0%	66.1%	15.2%	17.2%	0.3%	1.2%
EU-25	439 827	282 426	70 480	80 036	1 490	5 395
Share	100.0%	64.2%	16.0%	18.2%	0.3%	1.2%
BE	2 630	288	227	2 114	1	
BG	4 339	4 337	2			
CZ	3 141	2 380	22	739		
DK	10 619	23	6 614	3 982		
DE	64 662	19 581	27 229	16 570	1 282	
EE	97	22	54	21		
IE	1 873	631	1 112	130		
EL	6 406	5 017	1 266	122	1	
ES	43 964	19 553	21 219	3 114	78	
FR	58 444	52 285	963	5 181	15	
IT	49 751	36 067	2 344	5 985	31	5 324
CY	1				1	
LV	3 414	3 325	47	42		
LT	458	451		7		
LU	239	93	53	75	18	
HU	1 929	203	10	1 716		
MT						
NL	8 918	88	2 067	6 729	34	
AT	39 251	35 874	1 328	2 034	15	
PL	4 166	2 201	135	1 830		
PT	8 555	4 731	1 773	1 977	3	71
RO	20 213	20 207		6		
SI	3 575	3 461		114		
SK	4 645	4 638	7			
FI	23 564	13 784	170	9 607	3	
SE	82 045	72 808	936	8 301		
UK	17 480	4 922	2 904	9 646	8	
HR	6 347	6 333		14		
MK						
TR	39 748	39 561	59	34		94
IS	8 681	7 019		4		1 658
NO	136 681	135 796	506	379		
CH	31 234	31 226	8			

EU ENERGY AND TRANSPORT IN FIGURES
STATISTICAL POCKETBOOK 2007/2008

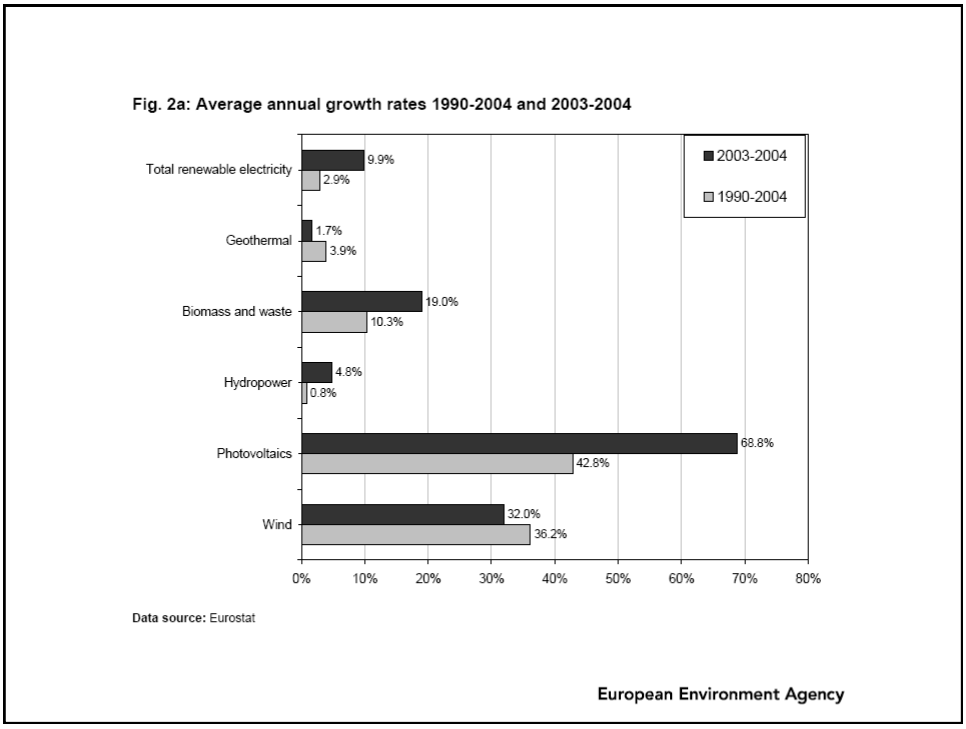


Fig. 2a: Average annual growth rates 1990-2004 and 2003-2004
2003-2004
1990-2004
Total renewable electricity
9.9%
2.9%
Geothermal
1.7%
3.9%
Biomass and waste
19.0%
10.3%
Hydropower
4.8%
0.8%
Photovoltaics
68.8%
42.8%
Wind
32.0%
36.2%
0% 10% 20% 30% 40% 50% 60% 70% 80%
Data source: Eurostat
European Environment Agency

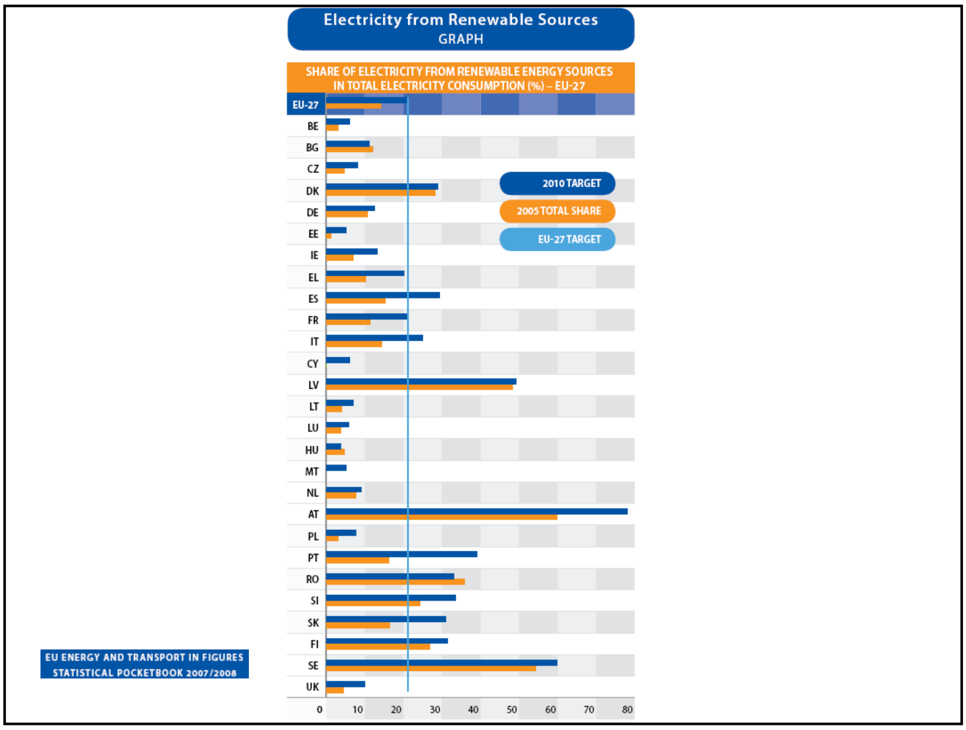

Electricity from Renewable Sources
GRAPH
SHARE OF ELECTRICITY FROM RENEWABLE ENERGY SOURCES IN TOTAL ELECTRICITY CONSUMPTION (%) – EU-27
2010 TARGET
2005 TOTAL SHARE
EU-27 TARGET
EU-27 BE BG CZ DK DE EE IE EL ES FR IT CY LV LT LU HU MT NL AT PL PT RO SI SK FI SE UK
0 10 20 30 40 50 60 70 80
EU ENERGY AND TRANSPORT IN FIGURES
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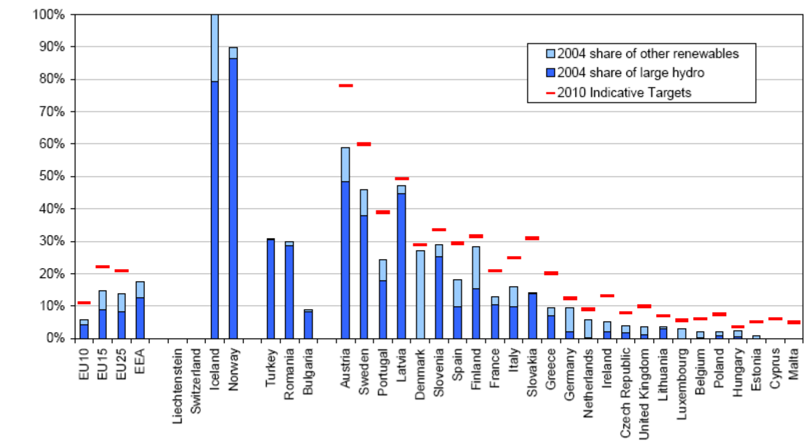
Fig. 1: Renewable electricity as a percentage of gross electricity consumption, 2004



Data source: Eurostat

Note: The electricity directive (2001/77/EC) defines renewable electricity as the share of electricity produced from renewable energy sources in gross electricity consumption. The latter includes imports and exports of electricity. The electricity generated from pumping in hydropower plants is included in gross electricity consumption but it is not included as a renewable source of energy. Large hydropower plants have a declared net capacity of more than 10 MW. No data is available for Liechtenstein or Switzerland from Eurostat.

European Environment Agency

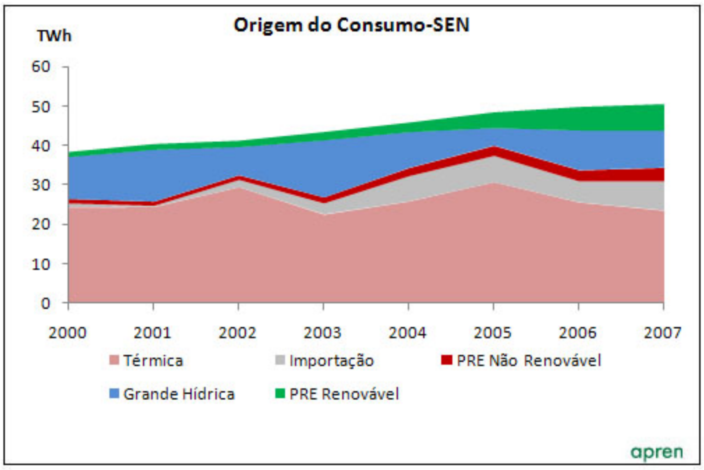
Annex I – National overall targets for the share of energy from renewable sources in final consumption of energy in 2020

A. National overall targets

	Share of energy from renewable sources in final consumption of energy, 2005 (S_{2005})	Target for share of energy from renewable sources in final consumption of energy, 2020 (S_{2020})
Belgium	2.2%	13%
Bulgaria	9.4%	16%
The Czech Republic	6.1%	13%
Denmark	17.0%	30%
Germany	5.8%	18%
Estonia	18.0%	25%
Ireland	3.1%	16%
Greece	6.9%	18%
Spain	8.7%	20%
France	10.3%	23%
Italy	5.2%	17%
Cyprus	2.9%	13%
Latvia	34.9%	42%
Lithuania	15.0%	23%
Luxembourg	0.9%	11%
Hungary	4.3%	13%
Malta	0.0%	10%
The Netherlands	2.4%	14%
Austria	23.3%	34%
Poland	7.2%	15%
Portugal	20.5%	31%
Romania	17.8%	24%
Slovenia	16.0%	25%
The Slovak Republic	6.7%	14%
Finland	28.5%	38%
Sweden	39.8%	49%
United Kingdom	1.3%	15%

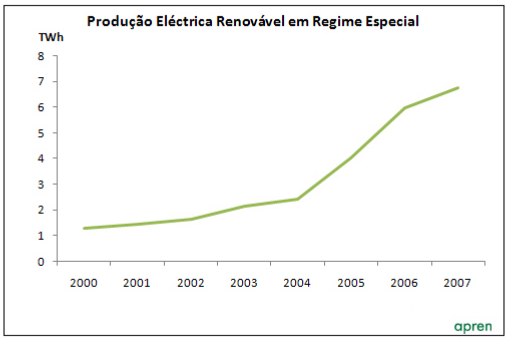
3. RENEWABLE ENERGY IN PORTUGAL AND SPAIN

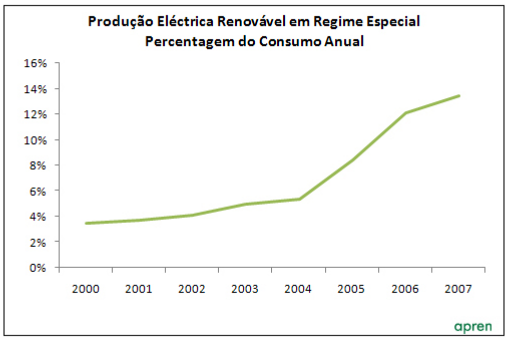
- PORTUGAL
- SPAIN



Notes:
Electricity consumption by source
Thermal-Imported-cogeneration
Hydro- renewable

Source: http://www.apren.pt/

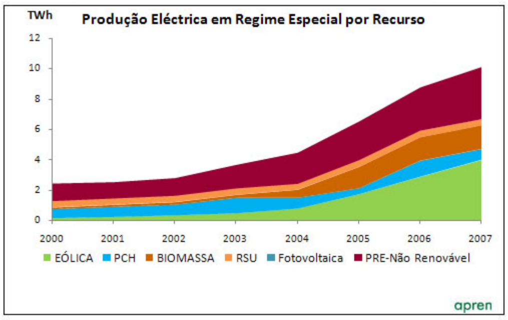


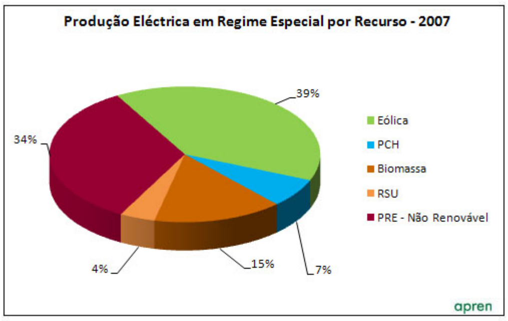


Notes:
Renewable electricity production in the Special regime (renewables, exc. large hydro and cogeneration)

Renewable electricity production in the Special regime as percentage of annual electricity consumption

Source: http://www.apren.pt/

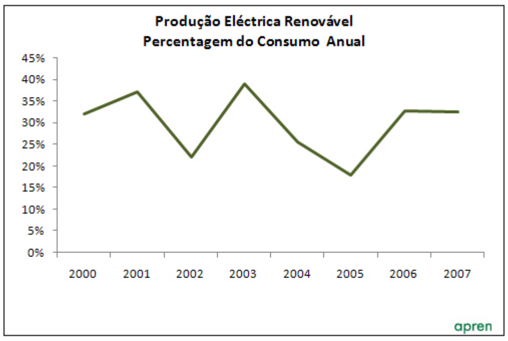




Notes:
Special regime electricity production by source

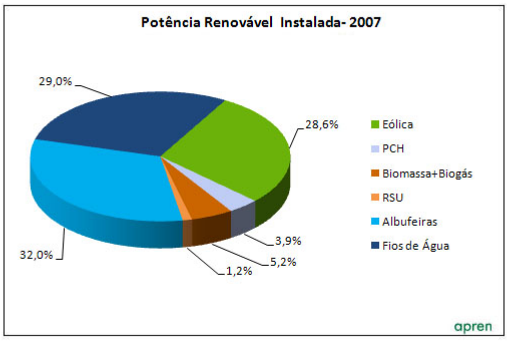
Wind-small hydro (under 10 MW)-biomass-municipal solid waste-photovoltaic-cogeneration

Source: http://www.apren.pt/

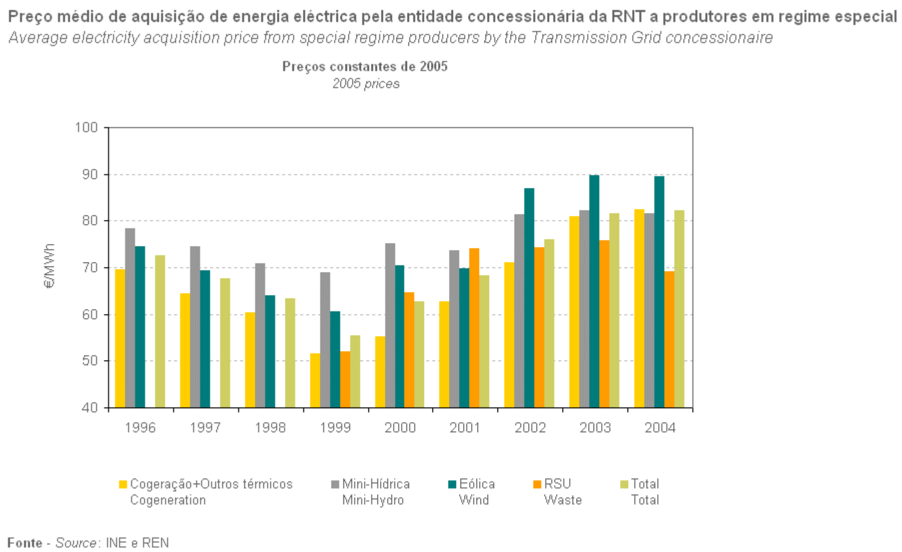


Notes:
Share of renewable electricity consumption in annual consumption

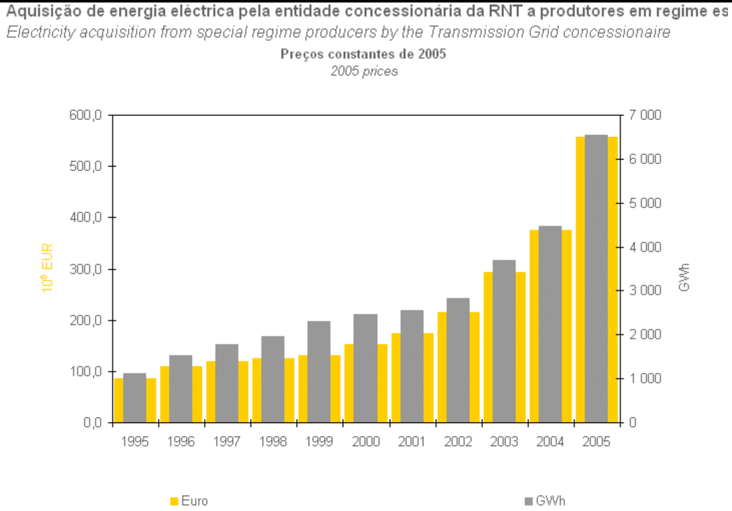
Renewable installed capacity – 2007
Wind-small hydro-biomass/biogas-municipal solid waste-dams - run-of-river



Source: http://www.apren.pt/



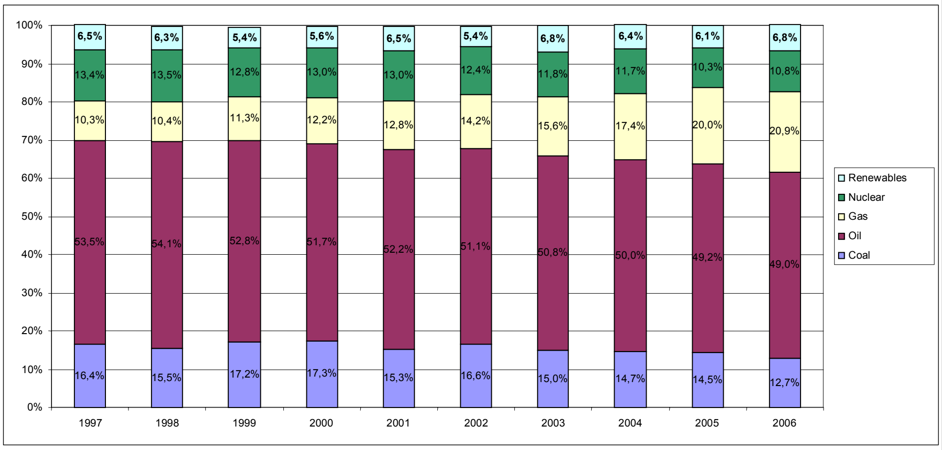
Source:
http://www.erse.pt/vpt/entrada/factosenumeros/sectorelectrico/portugalcontinental/producaogeneration/Preço+médio+de+aquisição+de+energia+eléctrica+pela+entidade+concessionária+da+rnt+a+produtores+em+re/Preço+médio+de+aquisição+de+energia+eléctrica+pela+entidade+concessionária+da+rnt+a+produtores+em+re.htm



Fonte - *Source*: INE e REN

Source: http://www.erse.pt/vpt/entrada/factosenumeros/sectorelectrico/portugalcontinental/producaogeneration/d/producaogeneration.htm

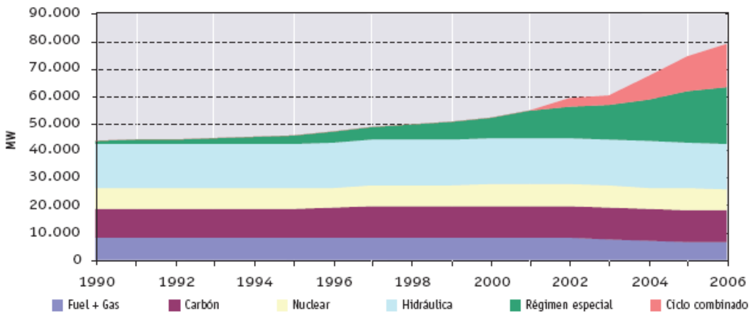
Spain



Source: http://www.cne.es/cne/Publicaciones

In 2006 the share of renewable energy (including large hydro) reached 6,8% of consumption against the objective of 12% by 2010.

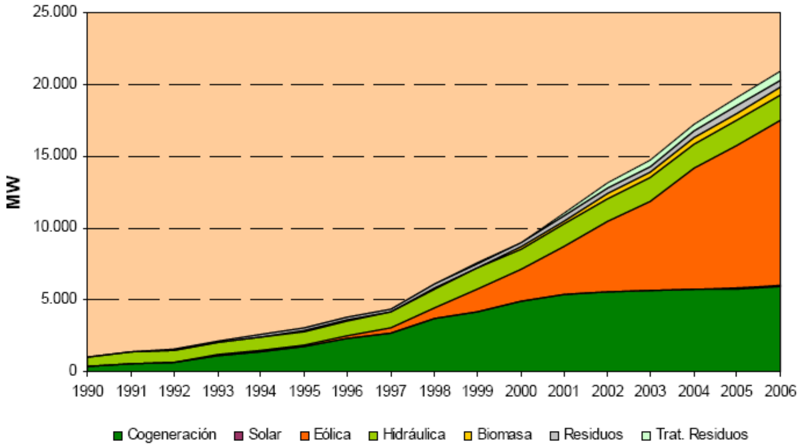
Gráfico 2.2.2. Evolución de la estructura de la potencia instalada (sistema peninsular)



Fuentes: REE.

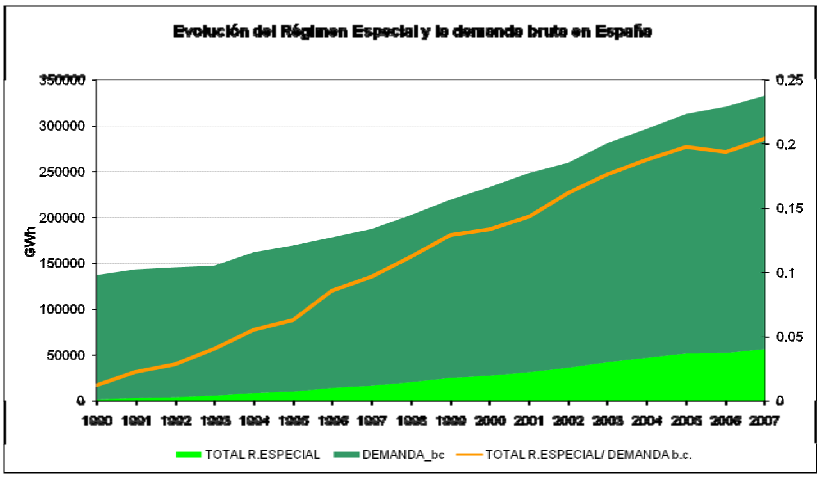
Notes:
Evolution of installed capacity (mainland Spain)
Oil and gas-coal-nuclear-hydro-renewables-cogeneration

Source: http://www.cne.es/cne/doc/publicaciones/informe_sectores/2007/PA002_07-electrico.pdf



Notes:
Evolution of installed capacity in the special regime (mainland Spain)
Cogeneration-solar-wind-hydro-biomass- waste- waste incineration

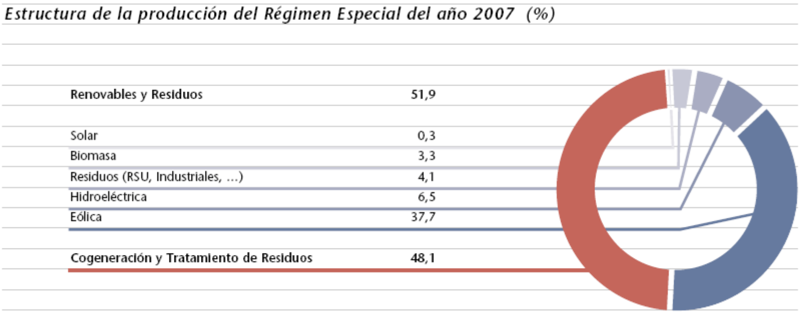
Source: http://www.cne.es/cne/doc/publicaciones/PA006_07.pdf



Source: http://www.cne.es/cne/Publicaciones

Notes: Evolution of installed capacity in the special regime (mainland Spain)
Cogeneration-solar-wind-hydro-biomass- waste- waste incineration

En 2007 las ventas de energía eléctrica por los productores en régimen especial en España han cubierto el 20% de la demanda bruta. Las ventas de electricidad procedente de energías renovables durante 2007 teniendo en cuenta la gran hidráulica, han supuesto el 20% de la demanda eléctrica bruta, existiendo el objetivo comunitario de conseguir en España una participación de las energías renovables del 29,4% en el consumo de electricidad en el año 2010.

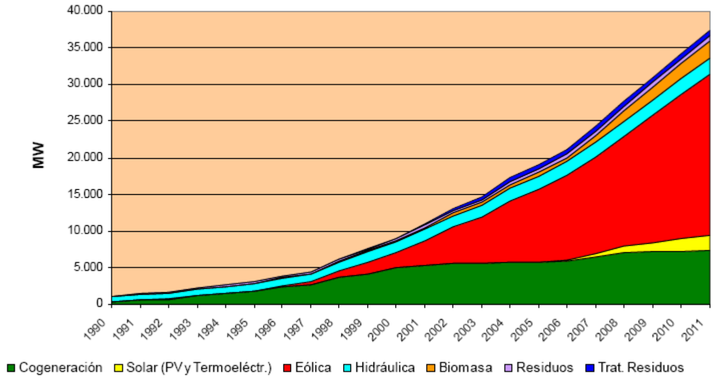


Notes:
The structure of production in the Special regime (2007)
Renewables and waste
Solar
Biomass
Waste (municipal, indutrial etc.)
Hydro
Wind
Cogeneration and waste incineration

Source: http://www.unesa.es/

Energy balance Del 1 de enero al 30 de abril			
Mainland gross production	Millones de KWh		% difference
	2007	2008	
Hydro	11.303	5.820	-48,5
Thermal	41.879	48.255	15,2
Nuclear	20.260	20.720	2,3
TOTAL GROSS PRODUCTION	73.442	74.795	1,8
Self consumption	2.771	2.797	0,9
Pumps' consumption	1.419	1.441	1,5
Electricity sold	69.252	70.557	1,9
Interconnection balance	-645	-3.573	453,6
Electricity purchased by the special regime	19.177	23.721	23,7
TOTAL DEMANd (mainland)	87.784	90.706	3,3

Source: http://www.unesa.es/



Potencia Instalada (MW)	2007	2008	2009	2010	2011
Cogeneración	6.432	7.000	7.123	7.247	7.370
Solar (PV y Termoeléctrica)	409	900	1.300	1.650	2.000
Eólica	13.288	14.980	17.320	19.660	22.000
Hidráulica	2.000	2.000	2.080	2.160	2.240
Biomasa y biogás	898	1.520	1.827	2.093	2.360
Residuos	600	600	610	660	710
Tratamiento de Residuos	625	650	675	700	700
Total	**24.252**	**27.650**	**30.935**	**34.170**	**37.380**

Figura 4.2.9. Previsiones de evolución de potencia del régimen especial en la Península por tecnologías. Fuente: CNE, Documento de Planificación y Plan de Energías Renovables.

Energía vertida (GWh)	2007	2008	2009	2010	2011
Cogeneración	17.366	18.900	19.233	19.566	19.899
Solar	429	1.080	1.950	2.476	3.000
Eólica	26.576	30.709	37.065	42.072	47.080
Hidráulica	4.399	4.400	4.992	5.184	5.376
Biomasa y biogás	2.695	4.560	7.307	8.373	9.440
Residuos	2.461	2.460	2.745	3.300	3.550
Tratamiento de Residuos	3.624	3.769	4.049	4.199	4.199
Total	**57.550**	**65.878**	**77.340**	**85.170**	**92.544**

Figura 4.2.10. Previsiones de evolución de ventas de energía del régimen especial en la Península por tecnologías. Fuente: CNE, Documento de Planificación y Plan de Energías Renovables.

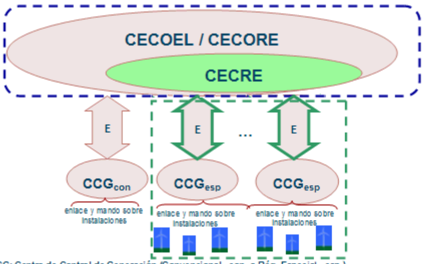
Notes:
The potential evolution of installed capacity of the special regime by technologies

Cogeneration-solar (PV and heat) – wind-hyrdo-biomass-waste-waste incineration

Source: http://www.cne.es/cne/doc/publicaciones/PA006_07.pdf

4. CHALLENGES FOR NETWORK OPERATORS

- ❑ **SYSTEM CONTROL**
- ❑ **GRID INVESTMENT**



CCG: Centro de Control de Generación (Convencional –con- o Rég. Especial –esp-)
E: Enlace (Iccp)

Source: http://www.ree.es/operacion/regimen_especial.asp

Cobertura para la punta máxima	2005 27 enero, 19-20 h		2006 30 enero, 19-20 h	
	MW	%	MW	%
Nuclear	7.374	17	7.588	18,0
Térmica clásica	13.014	30	12.646	30,0
CCTG	7.374	17	10.538	25,0
Hidráulica	5.639	13	4.215	10,0
Régimen especial	8.676	20	7.166	17,0
Int. Internacionales	1.301	3	0	0
TOTAL	**43.378**	**100**	**42.153**	**100**

Figura 2.2.32. Cobertura de la demanda de potencia media horaria para la punta máxima.
Fuente: Informe REE. Año 2006.

Source: http://www.cne.es/cne/doc/publicaciones/PA006_07.pdf

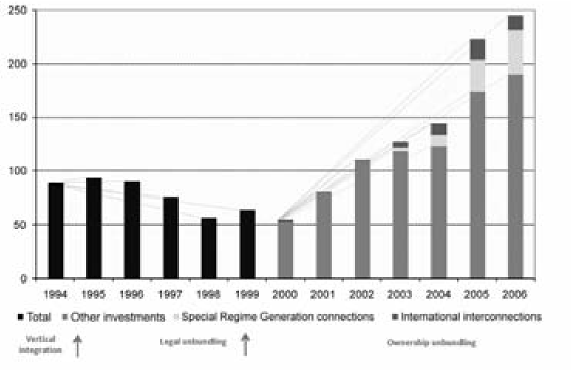
NETWORK OPERATORS HAVE DELAYED INTRODUCTION OF NEW TECHNOLOGIES

The cost of IT on an annual basis would appear to be in the range of 1% to 2% with Utilities engaged in the Distribution & Supply business having a higher penetration in general than those in the Generation and Transmission business.

This is low in comparison to a survey published by IEEE Power Engineering Review in February 1996 where investor-owned Electric Utilities in the United States tend to show an average investment into IT of close to 3% of revenues. This might confirm that a further growth of IT is to be expected.

Source: EURELECTRIC 1997 Benchmarking and Cost Control

NETWORK OPERATORS DO NOT TAKE ADVANTAGE OF NEW ICT

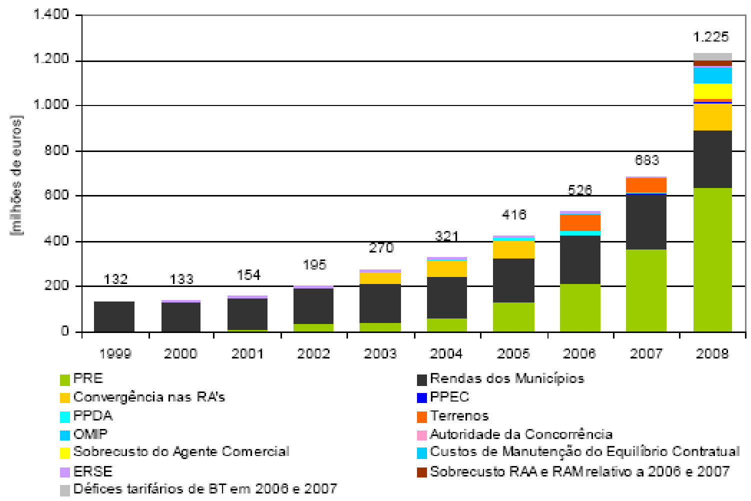


Source: http://www.erse.pt/NR/rdonlyres/789EA4BB-B104-42C9-A248-6332D9883136/0/livro_ERSE_final.pdf

5. CHALLENGES FOR REGULATORS

- INCENTIVES FOR NETWORK OPERATORS
- TARIFF INCREASE
- MARKET LIQUIDITY
- DEMAND RESPONSE

Figura 0-1 - Evolução dos custos de interesse económico geral incluídos nas tarifas desde 1999



Notes: The evolution of tariff structure since 1999

Quadro 0-11 - Diferencial de custo com a aquisição de energia eléctrica à Produção em Regime Especial em 2008

	Tarifas 2008				
	GWh	Preço médio de aquisição €/MWh	Custo Total 10^3 EUR	Preço médio de referência €/MWh	Diferencial de custo 10^3 EUR
Total da Produção em regime especial	13 165	96,65	1 272 411		640 491
Produção em regime especial enquadrados nos termos do Decreto-Lei n.º 90/2006	7 669	93,92	720 279		352 167
Eólicas	5 773	97,10	560 558	48,00	283 454
Hídricas	1 226	84,70	103 842	48,00	44 994
Biogás	40	83,40	3 336	48,00	1 416
Biomassa	95	83,40	7 923	48,00	3 363
Fotovoltaica	60	83,40	5 004	48,00	2 124
RSU	475	83,40	39 615	48,00	16 815
Produção em regime especial não enquadrados nos termos do Decreto-Lei n.º 90/2006	5 496	100,46	552 132		288 324
Térmica - Cogeração	5 420	100,70	545 794	48,00	285 634
Térmica - Outros	76	83,40	6 338	48,00	2 690

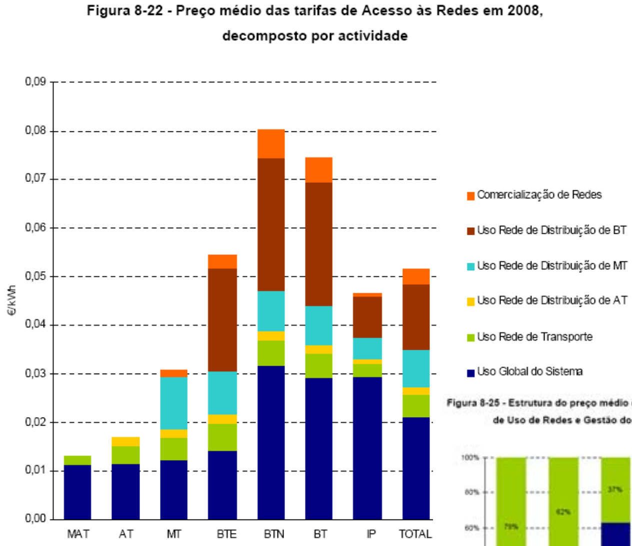
Fonte: ERSE

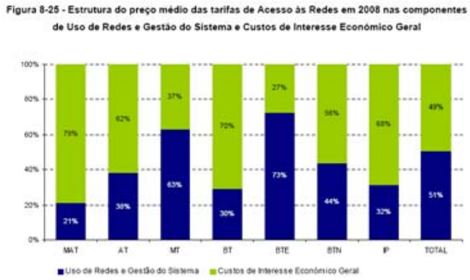
Cost differential between Special regime and reference power purchases in 2008

GWh-average purchase price-total cost-average reference price-cost difference

Total production in the Special Regime
Production in the specia regime under Act 90/2006
Wind
Hydro
Biogas
Biomass
PV
Municipal solid waste
Production in the specia regime NOT under Act 90/2006
Cogeneration
Other thermal production

Source: http://www.erse.pt/vpt/entrada/electricidade/tarifaseprecos/tarifasreguladasem2008/

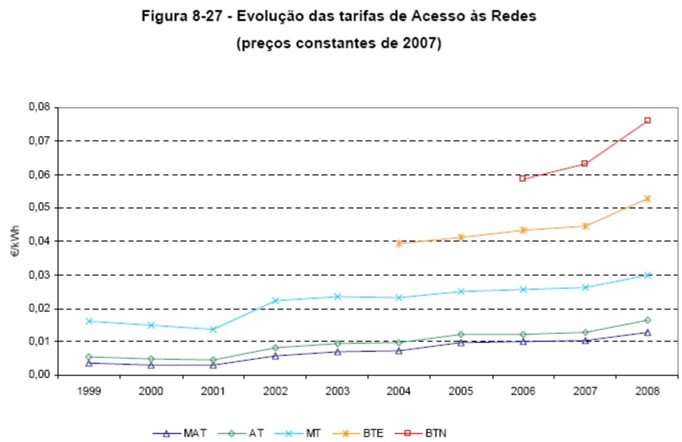




Notes:
Average network access tariffs in 2008 by components

MAT very-high voltage
AT high-voltage
MT medium-voltage
BT low-voltage

Source: http://www.erse.pt/vpt/entrada/electricidade/tarifaseprecos/tarifasreguladasem2008/

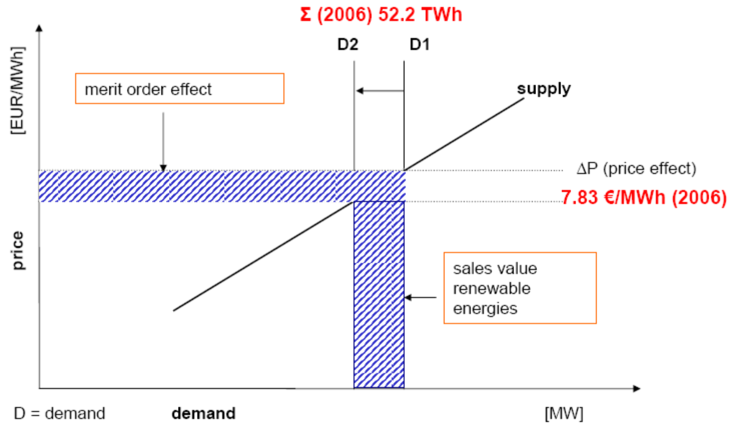


Notes: *Evolution of network access tariffs (at 2007 constant prices)*
MAT very-high voltage
AT high-voltage
MT medium-voltage
BTE low-voltage, large consumers
BTN low-voltage, small consumers

Source: http://www.erse.pt/vpt/entrada/electricidade/tarifaseprecos/tarifasreguladasem2008/

GERMANY

Merit-Order Effect of Power Supply through EEG



Total volume merit-order effect (2006): € 4.98 billions

Source: http://www.erneuerbare-energien.de/files/pdfs/allgemein/application/pdf/eusew_slides_langniss.pdf

THE SUPPLY-SIDE

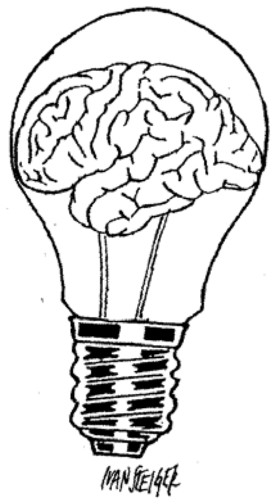
IS ONLY HALF OF

THE MARKET.

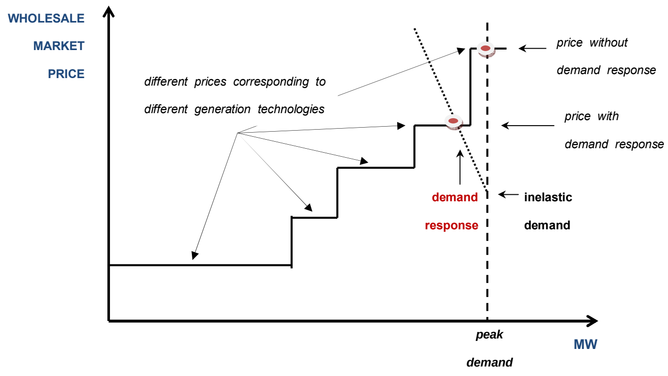
WE NEED NEW

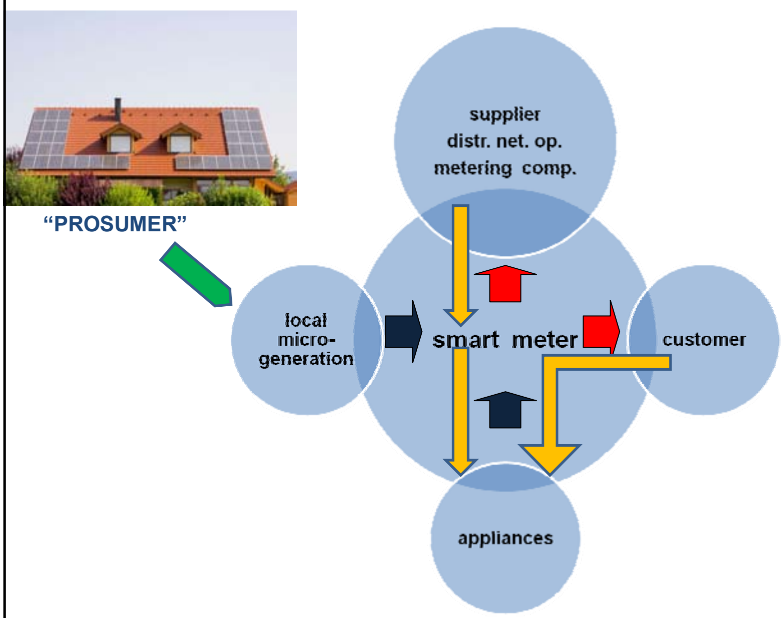
IDEAS ABOUT THE

DEMAND-SIDE



DEMAND PARTICIPATION IMPROVES MARKET EFFICIENCY





SMART METER - THE CORNERSTONE OF SMART ELECTRICITY GRIDS

4. CONCLUSIONS

- RENEWABLE ENERGY PART OF EU POLICY
- TARGETS ACHIEVABLE
- NETWORK MODERNIZATION URGENTLY NEEDED (ICT)

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The New RES Regulation: Green Package in Hungary

István Pataki
Vice President
Hungarian Energy Office

„Integration of more RES-E in the CEE region"

20-21. May 2008.

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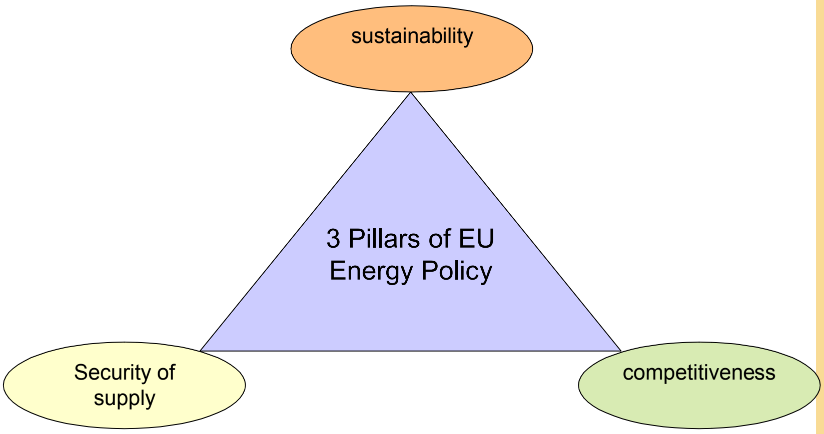
Policy background (1)



- Growing concern about security and continuity of oil and gas supplies; rising energy prices, despite the increased efficiency resulting from EU market liberalisation
- Climate change
- EU competitiveness policy: need for innovative industrial development and leadership

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Policy background (2) - European "green package"

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- A new **EU emissions trading scheme** with a European (not national) cap, auctioning of allowances: to generate reductions in GHG of 21%
- New national targets to achieve a 10% GHG reduction in **non ETS sectors**
- A framework to promote the development of **CO2 capture and storage**
- New guidelines on **state aid** for environmental protection
- An assessment of national **Energy Efficiency Action Plans**
- **New directive** to reach the 20% **renewable energy** target and 10% **biofuels** target

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RES Directive (1)

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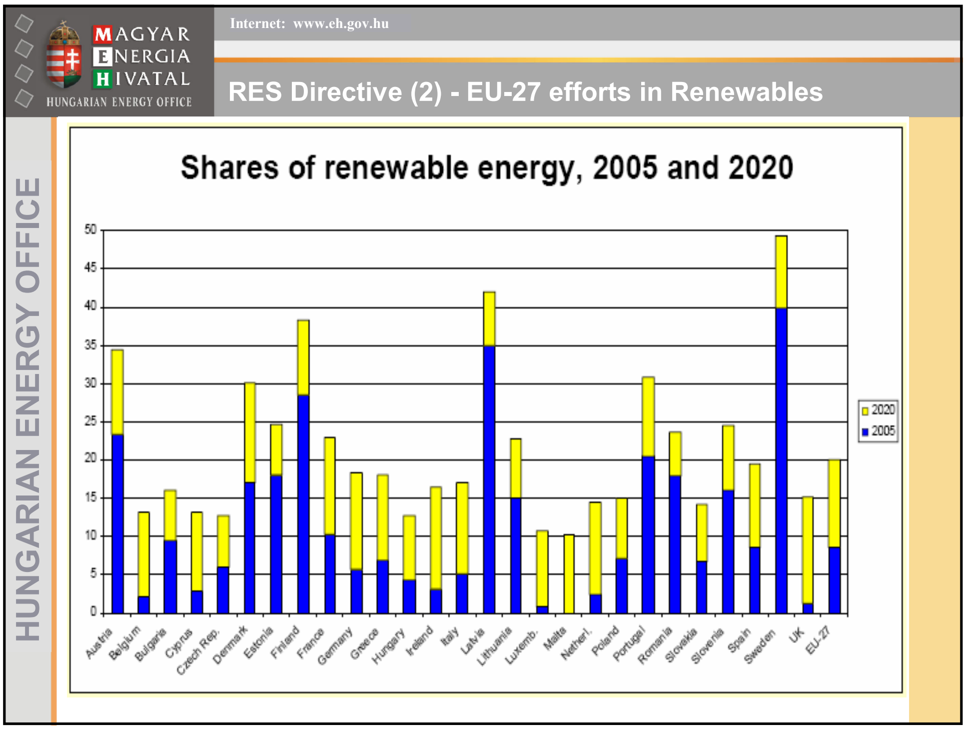
- Sets **mandatory national targets** for renewable energy shares, including
- **10% biofuels share**, in 2020 (*Articles 3 and 5)*
- Requires **national action plans** *(Article 4)*
- Requires **reduction of administrative and regulatory barriers** *(Article 12),* improvements in provision of information and training *(Article 13)* and improves renewables' access to the electricity grid *(Article 14)*
- Creates a **sustainability regime** for biofuels *(Articles 15-18)*
- Standardises "**guarantees of origin**" (certifying the renewable origin of electricity or heat) and enables the transfer of these to provide flexibility to Member States *(Articles 6, 7, 8, 9 and 10)*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RES Directive (2) - EU-27 efforts in Renewables
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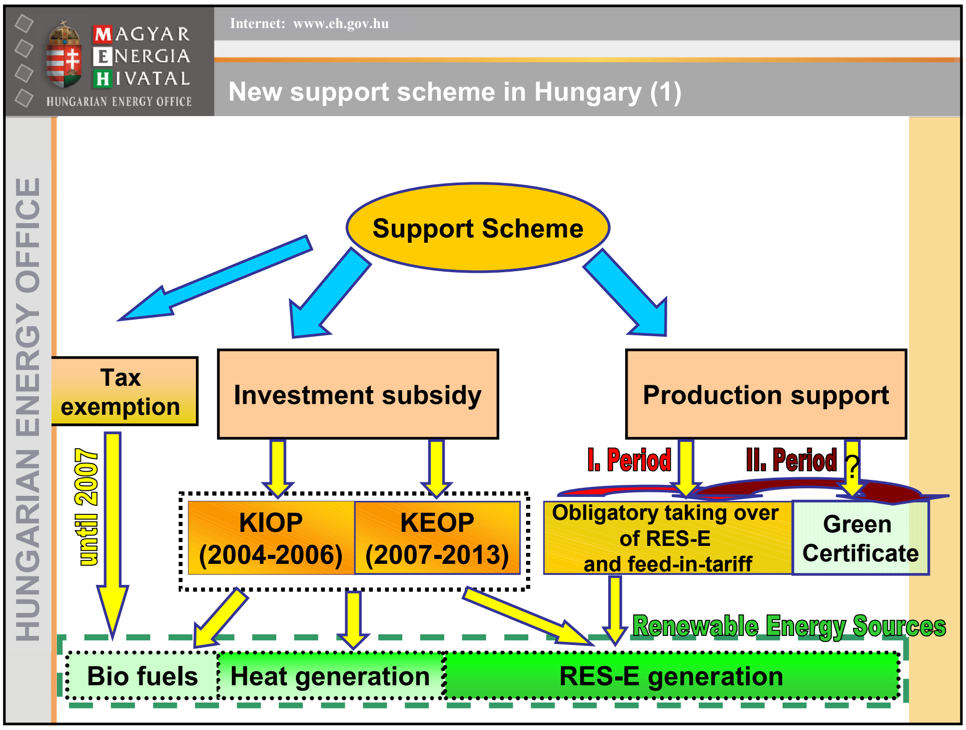
Shares of renewable energy, 2005 and 2020
0
5
10
15
20
25
30
35
40
45
50
2020
2005
Austria
Belgium
Bulgaria
Cyprus
Czech Rep.
Denmark
Estonia
Finland
France
Germany
Greece
Hungary
Ireland
Italy
Latvia
Lithuania
Luxemb.
Malta
Netherl.
Poland
Portugal
Romania
Slovakia
Slovenia
Spain
Sweden
UK
EU-27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New support scheme in Hungary (1)
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Support Scheme
Tax exemption
Investment subsidy
Production support
until 2007
I. Period
II. Period
?
KIOP (2004-2006)
KEOP (2007-2013)
Obligatory taking over of RES-E and feed-in-tariff
Green Certificate
Renewable Energy Sources
Bio fuels
Heat generation
RES-E generation

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New support scheme in Hungary (2) – Investment subsidy

KIOP (Operative Programme for Environmental Protection and Infrastructure)

1. **Period:** 2004-2006
2. **Financed by EU Funds**
3. **3 main fields:** environmental protection, energetics and transport
4. **For Renewable Energies:** 15 million EUR
   - **Supported projects:** 18
   - **Planned total RES-E generation / year:** 442 TJ
   - **Installed capacity:** 19,4 MW
   - **Saved CO2:** 2 million tons (for a whole life cycle)

KEOP (Operative Programme for Environment and Energy)

1. **Period:** 2007-2013
2. **Financed by EU Funds**
3. **2 main fields for Energetics:** Energy savings and Renewables
4. **For Renewable Energies (RES-E and heat generation):** 250 million EUR
   - **Supported projects:** biomass, biogas, geothermal, small scale wind turbines
5. **For Biofuels:** 45 million EUR
   - **Supported projects:** biofuel factories middle- and large scale capacities

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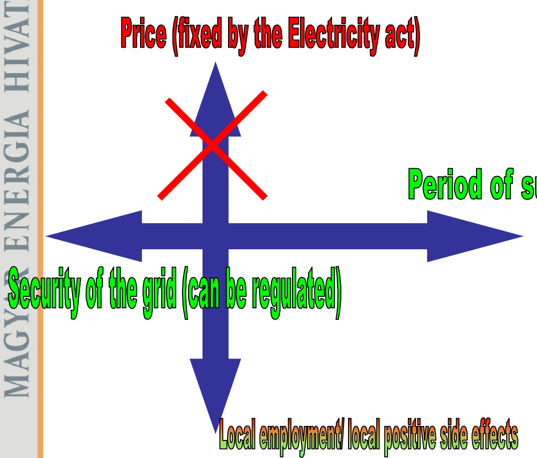
New support scheme in Hungary (3) – Wind tendering

- For new wind turbines >> tendering



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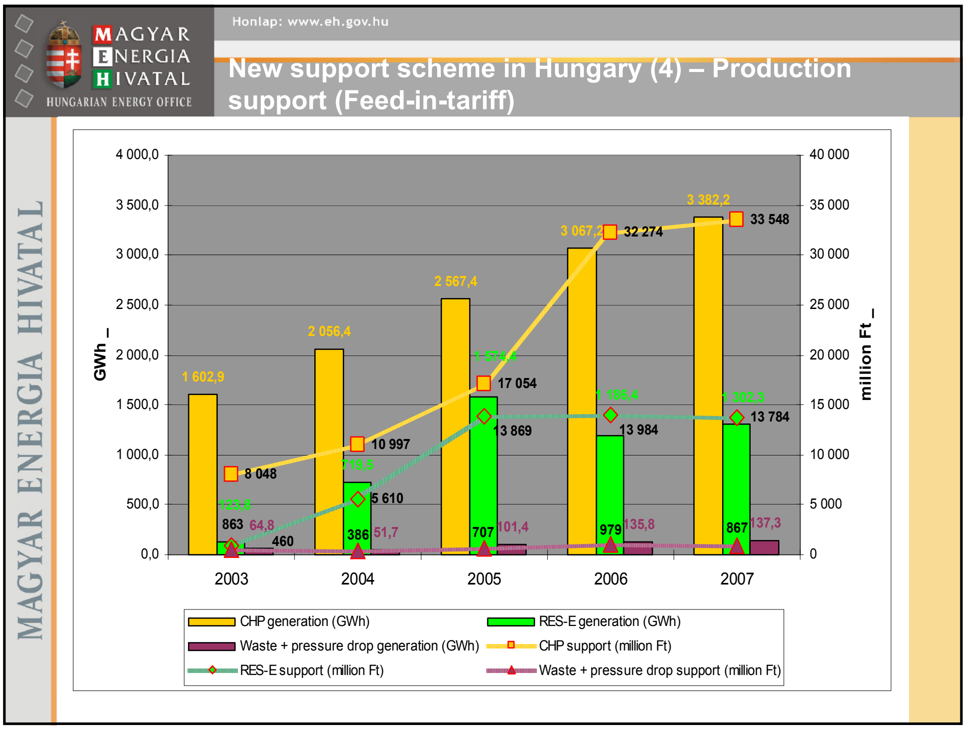
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New support scheme in Hungary (4) – Production support (Feed-in-tariff)
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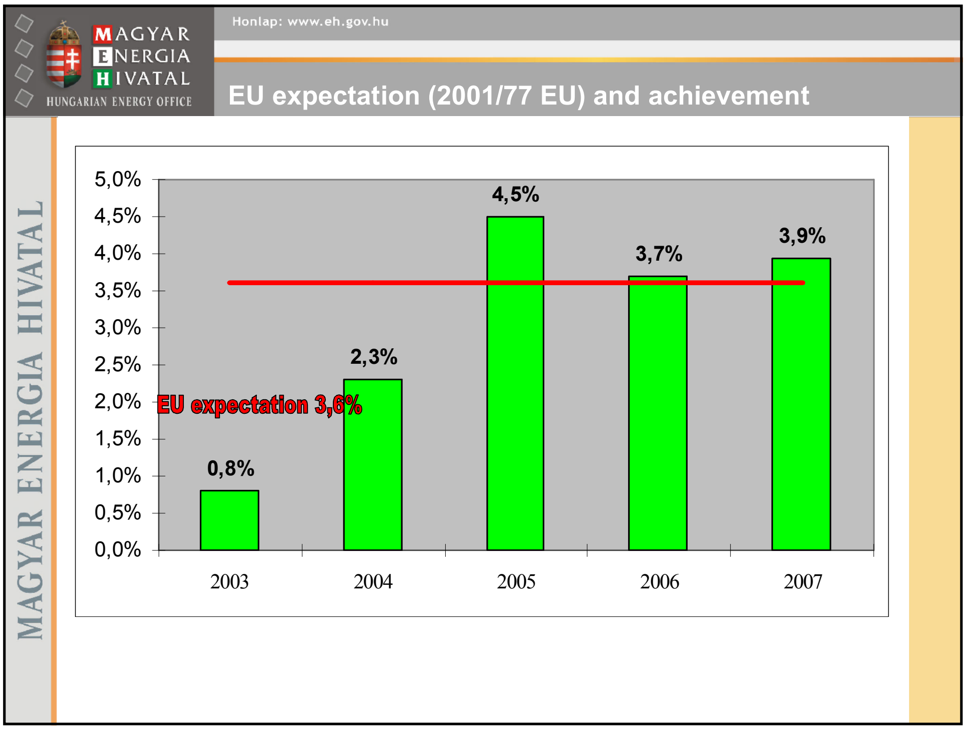
GWh
million Ft
4 000,0
3 500,0
3 000,0
2 500,0
2 000,0
1 500,0
1 000,0
500,0
0,0
40 000
35 000
30 000
25 000
20 000
15 000
10 000
5 000
0
1 602,9
2 056,4
2 567,4
3 067,2
3 382,2
8 048
10 997
17 054
32 274
33 548
123,8
719,5
1 574,4
1 186,4
1 302,3
5 610
13 869
13 984
13 784
863
386
707
979
867
64,8
51,7
101,4
135,8
137,3
460
2003
2004
2005
2006
2007
CHP generation (GWh)
RES-E generation (GWh)
Waste + pressure drop generation (GWh)
CHP support (million Ft)
RES-E support (million Ft)
Waste + pressure drop support (million Ft)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EU expectation (2001/77 EU) and achievement
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5,0%
4,5%
4,0%
3,5%
3,0%
2,5%
2,0%
1,5%
1,0%
0,5%
0,0%
0,8%
2,3%
4,5%
3,7%
3,9%
EU expectation 3,6%
2003
2004
2005
2006
2007

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Future development (1)

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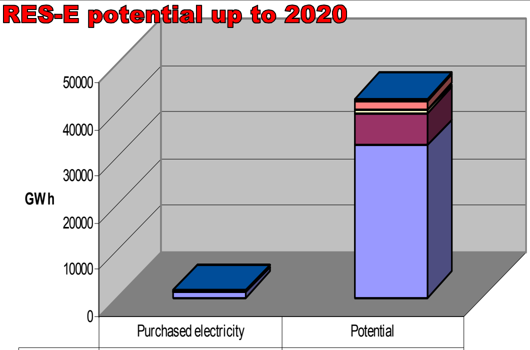
Hungarian RES-E potential up to 2020



	Purchased electricity	Potential
PV	0	550
wind	107	1660
small hydro	40	60
large hydro	165	200
geothermal	0	600
biogas	13	6940
biomass	1135	32500

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Future development (2)

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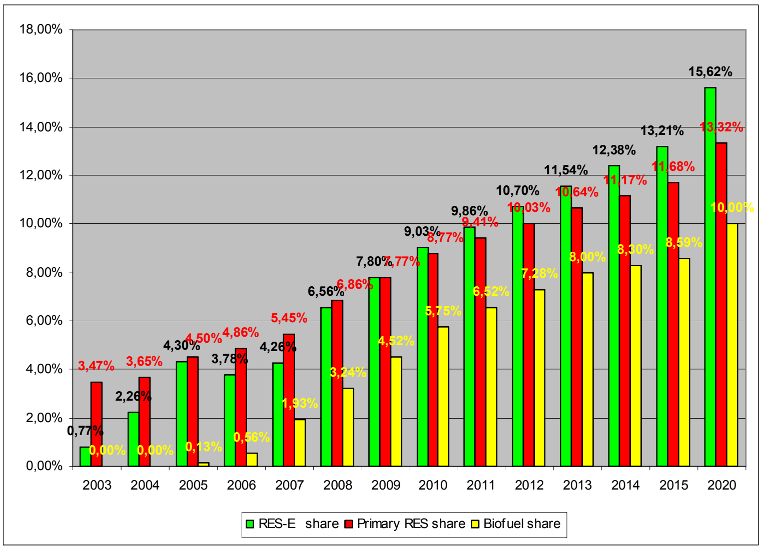
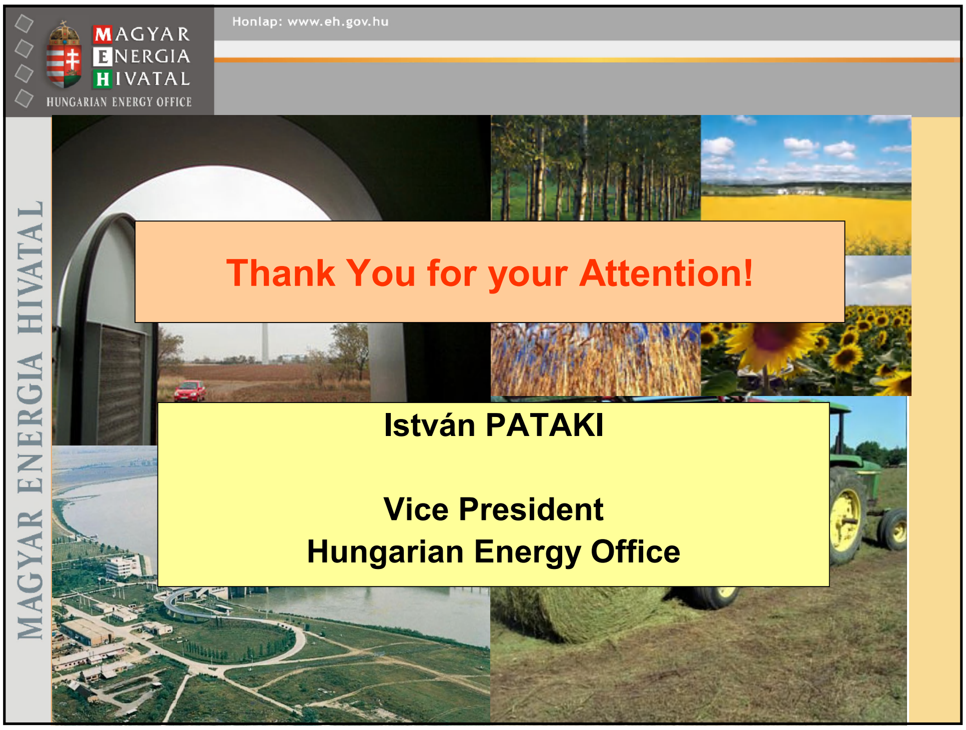
Expected RES-E share of Hungary (according to RES-E strategy)

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Thank You for your Attention!
István PATAKI
Vice President
Hungarian Energy Office

New Legislative and Regulatory Measures for the Development of RES Technologies & Applications in Greece and Experiences Encountered after Two Years of Programme Activity

Dr C Protogeropoulos
Mechanical Engineer

RENI, member of Solar Cells Hellas Group

Some Background Information

Act 2244 of 1994: established the legislative environment in Greece for the development of RES, providing access to the grid to individual energy producers.

Act 2773 of 1999: established the RAE (Regulatory Authority for Energy) and initiated deregulation of the electricity energy market.

Operational Programme for Competitiveness (OPC): major support scheme for RE investments. For PV systems, OPC subsidies varied between 40% and 50% in the period 2000–2006.

Act 2244/1994 proved to be insufficient: some 13 additional laws, common ministerial and circular decisions etc. were put in place to resolve important processing and technical issues. The regulatory and legislative environment was confusing and extremely bureaucratic, restraining the development of RES in the country.

Rational: why PVs in Greece?

- The **potential** for PV applications is huge; high solar resource in combination with increasing energy needs. **Public awareness** on solar energy is positive; the success of solar thermal could be repeated.
- PV integration on **island grids** is several **×10MWp**. PV electricity is **cost-competitive** on small/medium size islands.
- **Enforcement of the Utility Grid** during peak load demand is of high value, especially during summer periods.
- **Minimisation of Grid Losses** (energy production close to consumption), **transmission lines relief** and **re-scheduling of new investments** for the Grid.
- PV industry is already activated in Greece. Favourable **market conditions** and an **appropriate framework** environment is the driving force for further industrial development.

The Legislation: Law 3468/2006 (1/2)

- The new Law 3468/06 constitutes the legislative and regulatory framework basis for the initiation of sustainable RES activities in the country, PV included.
- The Feed–in–Tariff (FiT) model that has been introduced includes favourable conditions for grid-connected PV application.
- For PV applications, Law 3468 **does not** introduce a cap; there is reference to targets expected to be achieved by 2020, i.e. 500MW in the mainland and 200MW on islands.
- A PV Programme has been established to monitor progress, targets achieved and suggest rescheduling if necessary.
- Licensing procedures include the **Energy Production License (EPL)**, **Environmental Impact** studies and approvals and the **Installation and Operation** permits. The maximum time to obtain all licenses for a fully-licensed PV station is calculated **305 working days**.

The Legislation: Law 3468/2006 (2/2)

Power Supply Source	Feed-in Tariff, [Euro cent/kWh]	
	Interconnected System	Non-interconnected Islands
Wind, Small Hydro, Biomass, Geothermal, other RES, he–CHP	7.30	8.46
Wind, off-shore	9.00	9.00
PV Solar <100kW$_p$	**45.00**	**50.00**
PV Solar ≥100kW$_p$	**40.00**	**45.00**
Other Solar <5MWe	25.00	27.00
Other Solar ≥5MWe	23.00	25.00

Validity of Contracts: 10years (+10y renewal depending on the producer).

Prices: modified every year according to the inflation

The Ministries

Ministry of Development (MoD)

- Energy planning of the country.
- Main legislative/regulatory measures, etc.
- OPCE (Operational Programme for Competitiveness and Enterprise): to be announced within 2008, with subsidies for RES (PV-residential?).

Ministry of Environment , Land planning and Public Works

- A common ministerial decision is expected for the zoning and conditions of land positioning of RES.

Ministry of Economy and Economics

- Subsidisation through the Development Law 3299/2004. The whole process is on a competitive basis and subject to governmental budgets available. The minimum budget of a project to be considered as an investment is 100,000Euro.
- 4^{th} Community Support Framework: now called NSRF – National Strategic Reference Framework, currently under way.

The Authorities

Regulatory Authority for Energy (RAE)

- Evaluation of proposals and consultation to MoD for issuing Energy Production Licences (EPL)
- Fine tuning of PV Programme development in short/medium-term horizon.

Hellenic Transmission System Operator (HTSO, in Greek DESMIE)

- Contract for conditions of feeding energy to the grid and tariffs.

Town/Urban Planning Authorities

- Approval of a building licence; communication in done on a local level.

Centre for Renewable Energy Sources (CRES)

- Final approval and delivery of installations.

Other Authorities: Direction of Environment & Land Planning (DELP), 3 Archaeology Departments, 6 other authorities , Prefecture Council etc.

PV System Categorisation

Small systems of capacity ≤20kWp

These systems are exempted from an EPL process. Application for grid connection is done directly to the local utility office. Subsidisation possible for systems close to the 20kWp threshold, establishment of company required.

Medium size systems 20kWp<P≤150kWp

Applications for exemptions from an EPL are submitted to RAE. In September 2007, RAE discontinued the process due to the large amount of applications received.

Large systems >150kWp

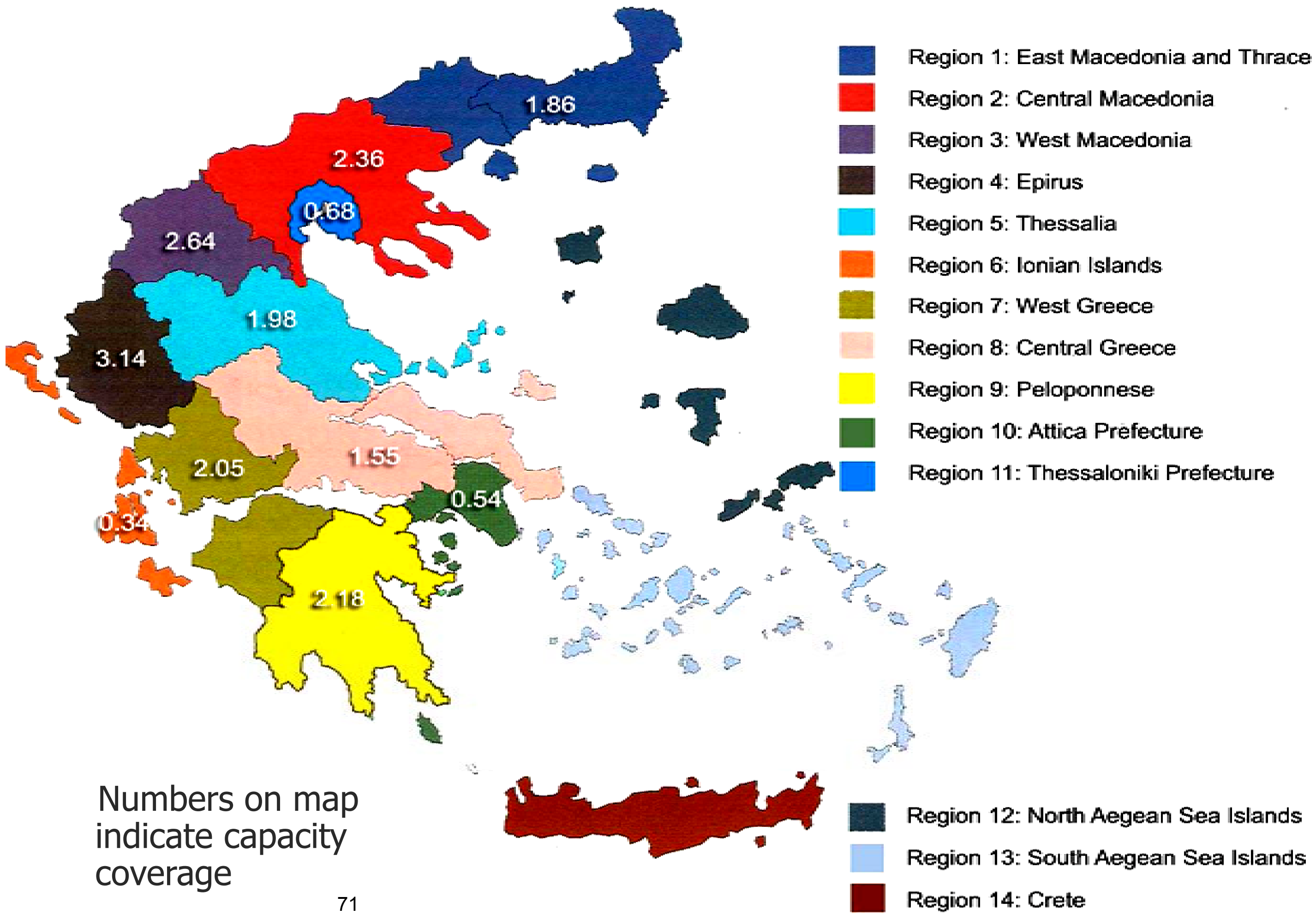
In the last summers' regional planning for the development of PV applications, RAE introduced 2 sub-groups in this category: **150kWp<P≤2MWp** and **P>2MWp**. Submission of proposals for evaluation is taking place during the first 10 calendar of each even month. In March 2008, RAE discontinued the process due to the large amount of applications received.

Planning of PV Installations

- Capacity planning of PV is based on a regional distribution in the country.
- In total, 14 regions have been identified in Greece.
- Determining the limitation of PV in each region is based mainly on the demand needs, the grid infrastructure and the planning of other RES in the region.
- The first phase of the PV Programme has been introduced for years 2007–2010.
- Applications received so far cover the planned capacity by an **average factor of 400%**.
- First results of applications received for each system category are shown in the following slides.

Applications' Register: 20kWp<P≤150kWp

Region	Planned MW_p
1	15.00
2	24.00
3	3.00
4	5.40
5	16.50
6	4.50
7	18.00
8	18.00
9	36.60
10	12.00
11	4.50
Total:	**157.50**



Numbers on map indicate capacity coverage

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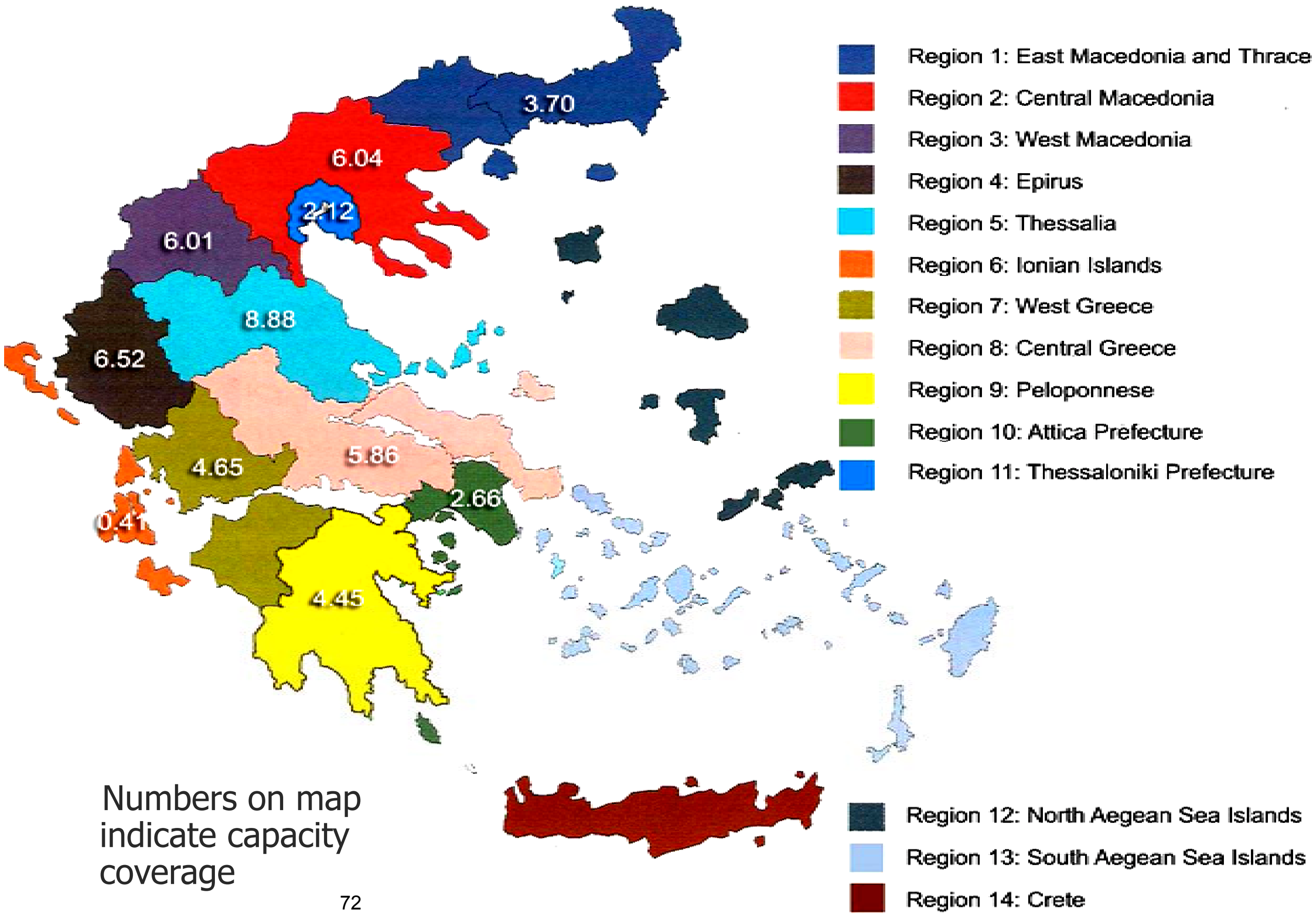
DIRECTORATE-GENERAL
Joint Research Centre

Applications' Register: 150kWp<P≤2MWp

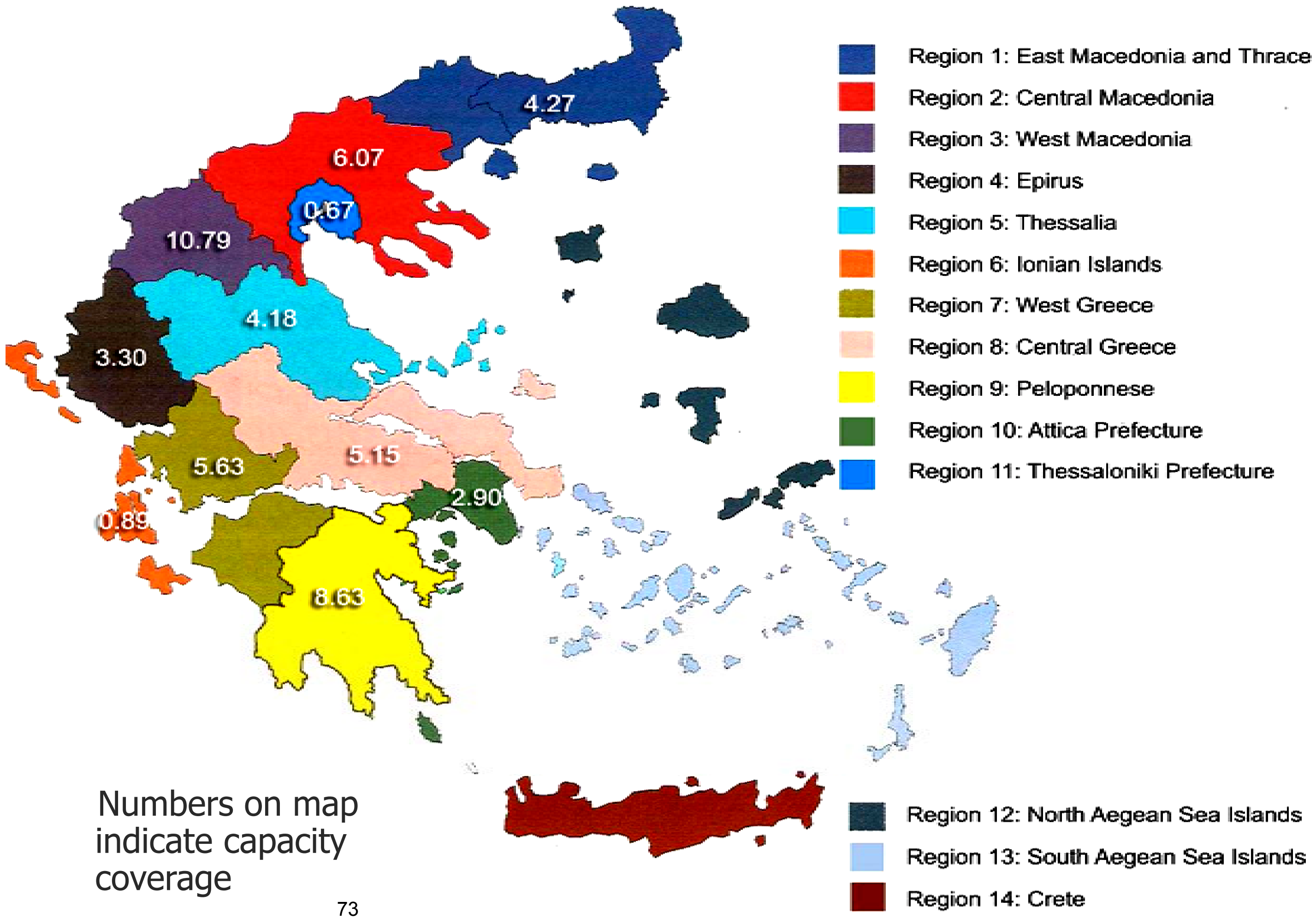
Region	Planned MW_p
1	13.00
2	15.00
3	3.00
4	5.40
5	16.50
6	4.50
7	18.00
8	18.00
9	36.60
10	12.00
11	4.50
Total:	**146.50**



Numbers on map indicate capacity coverage

Applications' Register: P>2MWp

Region	Planned MW_p
1	12.50
2	15.00
3	3.00
4	5.40
5	16.50
6	4.50
7	18.00
8	18.00
9	36.60
10	12.00
11	4.50
Total:	**146.00**



Numbers on map indicate capacity coverage

Latest Update on PV Development in Greece (1/4)

Exemptions: 20kWp<P≤150kWp , Interconnected Systems (*source: RAE, 13.02.2008*)

Status of Applications	No of Applications	PV Power, [kWp]
Positive Decision (after 2006)	979	100,846
Negative Decision	71	7,955
Recalled	3	298
Withdrawn	93	9,354
Under Evaluation	2,626	280,322
Total	**3,772**	**398,775**

Exemptions: 20kWp<P≤150kWp , Non-interconnected Islands (*source: RAE, 15.12.2007*)

Island Region	No of Applications	PV Power, [kWp]
North Aegean Sea	632	70,623
Ionian Sea	18	2,194
Crete	1,623	180,631
South Aegean Sea	727	75,077
Total	**3,000**	**328,525**

Latest Update on PV Development in Greece (2/4)

EPL Licences: P>150kWp, Interconnected Systems (*source: RAE, updated 15.02.2008*)

Status of Applications	No of Applications	PV Power, [kWp]
Positive Decision (after 2006)	36	89,090
Under Evaluation	1,203	2,619,390
Total	**1,239**	**2,708,480**

Overall so far (small system below 20kWp not accounted):

- 8,011 applications
- 3,436MW equivalent PV capacity

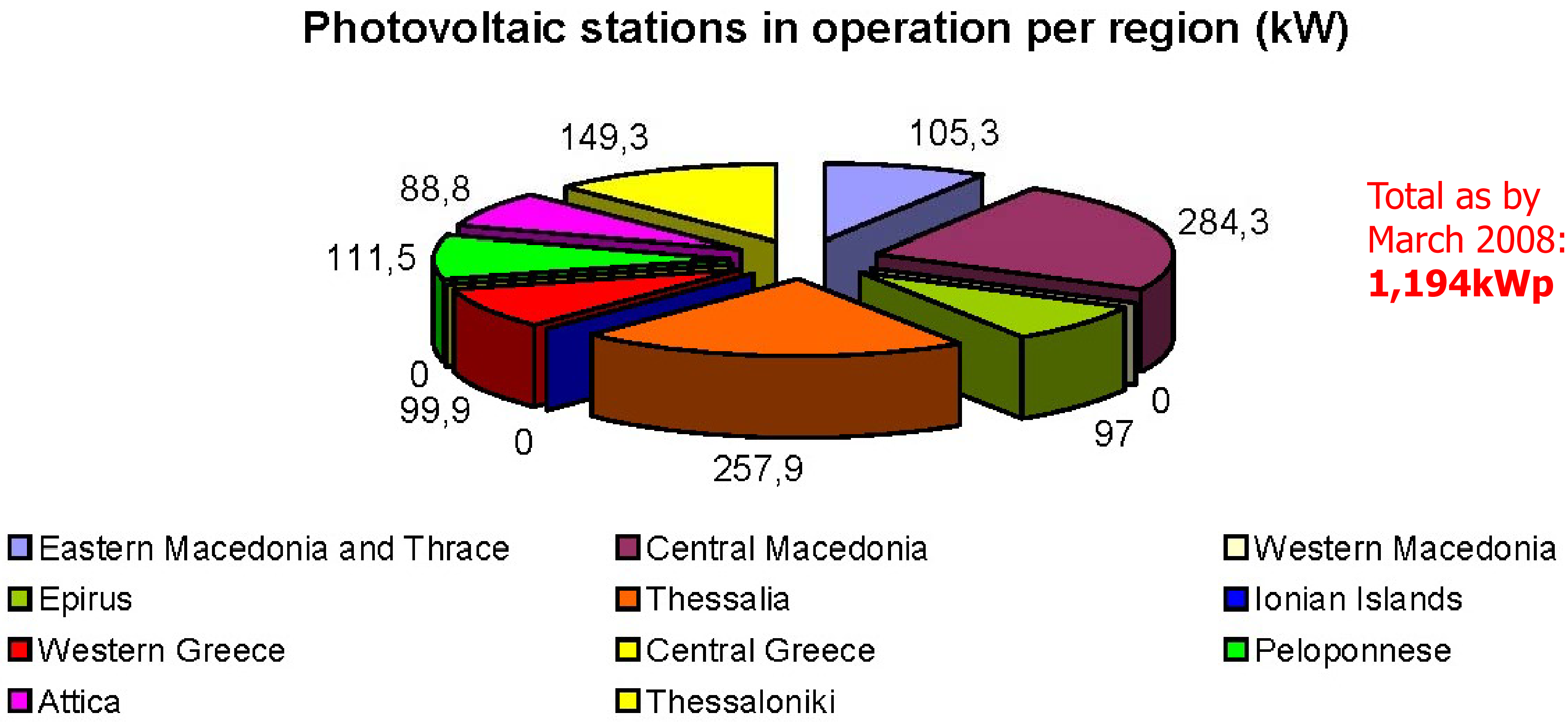
Latest Update on PV Development in Greece (3/4)

Photovoltaic stations of the interconnected system 2008
(Article 9, Law 3468/2006)

Month	Energy generated (MWh)	Capacity (kW)	
		With PPA	In operation
January	77,38	4.880,50	889,80
February	40,26	6.361,96	1.076,50
March	97,29	6.851,50	1.193,99
April			
May			
June			
July			
August			
September			
October			
November			
December			
Energy generated in 2008 (MWh)	214,92	* In Low Voltage the energy generated is metered every 4 months (Law 3468/2006)	

Source: HTSO, report on RES March 2008

Latest Update on PV Development in Greece (4/4)



Total as by March 2008: **1,194kWp**

Source: HTSO, report on RES March 2008

Potential for PV Development in Greece (1/2)

- As of the end of 2007, the total PV installed capacity is Greece was 6.5–7.0 MW.
- The PV market in Greece is expected to explode in the next 3–5 years, especially for medium size and larger capacity PV systems.
- In the February's applications for Energy Production Licence, submissions to RAE were a lot fewer compared to previous openings in 2007.
- Speeding-up the evaluation process will resolve the long awaiting list issue and will create sustainable conditions for market development.
- Applications for interconnected islands are expected to open in Sept./Oct. 2008.
- Power applied for and capacity of real systems installed should not be confused.

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Potential for PV Development in Greece (2/2)

	2006	2007	2008	2009	2010	2011	2012
Germany	850	**1100**	1500	1500-1750	1500-2000	1650-2200	1800-2400
Spain	97	**300**	300-500	300-500	400-600	400-600	400-600
Italy	12	**40**	80-150	130-300	200-400	270-540	360-730
Greece	**1,2**	**2**	**10-20**	**50-100**	**100-200**	**130-270**	**180-360**
France	14	**45**	60-150	120-250	200-300	270-400	360-540
Portugal	2	**10**	15-20	20-40	30-50	40-70	50-90
USA	141	**259**	350-400	600-800	1000-1400	1350-1900	1800-2550
China	12	**20**	25-35	35-70	50-100	70-140	90-180
Japan	286	**230**	200-300	200-400	200-500	270-680	360-910
South Korea	21	**50**	100-150	250-300	400-500	540-680	730-910
India	12	**20**	100-150	200-300	300-400	410-540	545-730
Rest of the World	150	**170**	200-250	250-350	300-500	410-680	545-910
TOTAL	**1598**	**2246**	**2940-3625**	**3655-5160**	**4680-6950**	**5810-8700**	**7220-10910**

Source: EPIA X-mas Workshop 2007

Solar Cells Hellas Group of Companies

1. **Production of Si Wafers, Cells and Modules**

   Solar Cells Hellas, SolTech and Energy Solutions

2. **Services, Marketing & Construction of Power Supply Systems**

   RENI – Renewable Energy Innovations

3. **Development of Photovoltaic Projects**

   Solar Datum, 4E Energy, Solar Concept, Spes Solaris etc.

Solar Cells Hellas SA – Company Overview

- The company was found in 2005.
- Factory now under development in the industrial zone of Patras.
- Production of crystalline silicon wafers, cells and modules.
- Final annual capacity 60MW.
- First 30MW production: July 2008.
- Full capacity: end 2008.

- Facilities: buildings 14.000m^2, land 37.000m^2.
- Working Positions: 230
- www.schellas.gr

Recommendations / Conclusions

- The **FiT** process has proven to be the most appropriate tool for PV support; tariffs have to be wisely set in each country to initiate a sustainable market and meanwhile avoid profiteering.
- **Subsidisation**: cash on the table disorientates the investors, prolongs project finalisation and diminishes the benefits of the FiT mechanism.
- Better to avoid a **cup** in a new PV Programme. The desired PV capacity should be reached gradually and smoothly, not in a very short time period.
- After a first period of a PV Programme, **fine-tuning** of the legislative and regulatory framework maybe necessary. The role of local authorities is important but should not become a barrier to PV development.
- A successful PV Programme should include the **household sector** as a priority. Licensing and other financial procedures for the implementation of solar PV systems in buildings should be simplified.
- **Research** on new solar technologies and the **PV industry** should develop in parallel to applications in a country and vice – versa.

Thank You for Your attention

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Economic analysis of energy storage requirements in connection with RES-E

András Mezősi

JRC-REKK Conference

May 20-21th 2008, Budapest

Presentation outline

- Energy storage systems
- Benefits of a pumped storage
  - Peak – off-peak arbitrage
  - Ancillary service
- Best practice regulation
- Conclusion

2

Energy storage systems

REKK Regional Centre for Energy Policy Research

- Pumped Hydroelectric Storage (PHS)
  - 90 GW worldwide
  - Efficiency from 60 % to 80 %
  - 100-1000 MW
- Compressed Air Energy Storage
  - Below 0.5 GW worldwide
  - Efficiency around 70-75 %
  - 50-100 MW
- Other energy storage systems
  - Flywheel, Conventional batteries, Flow batteries, Hydrogen fuel cells
- Demand side management
  - Real physical storage
  - Reduce peak consumption

3

Cost and Benefits of PHSs

REKK Regional Centre for Energy Policy Research

- Benefits
  - Peak vs. off-peak arbitrage, reduce peak – off-peak generation margin

    and/or (?)
  - Ancillary service
- Costs
  - Overnight cost
  - O&M costs
  - Social costs (e.g. external cost of the building)

4

Is this a real arbitrage?

REKK Regional Centre for Energy Policy Research

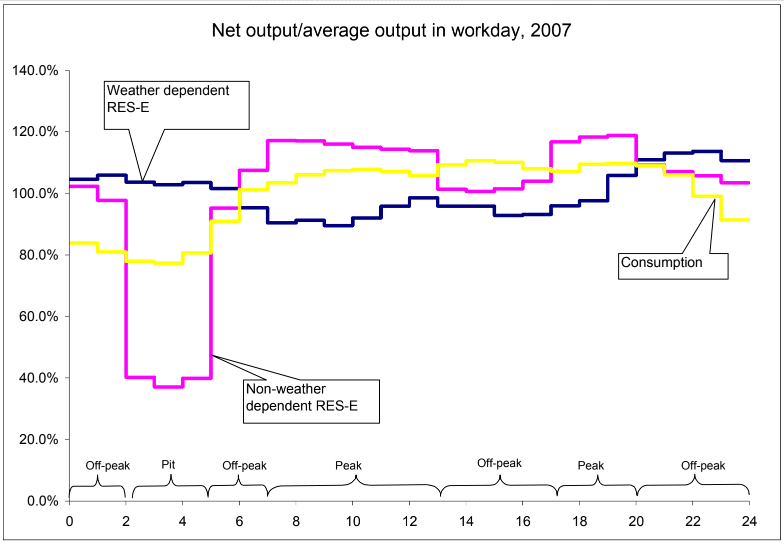
Peak off-peak margin (€/MWh)	20
Overnight cost (€)	600 000 000
Installed capacity (MW)	600
Daily production (MWh)	3 000
Net efficiency (%)	80%
Yearly production (MWh)	876 000
Yearly income (€)	17 520 000
Payback period with 0 discount rate (year)	**34,2**

Without state support PHS is not profitable in Hungary!

5

The effect of differentiated FIT I.

REKK Regional Centre for Energy Policy Research



6

The effect of differentiated FIT II.

- More than 90 % of the non-weather dependent RES-E is biomass
- Biomass can be stored, so these PPs can give and keep their schedule

⇩

Getting price signals, they can react to the changing electricity price

But this price is set by administrative way not evaluated in the market!

(„second best" regulation)

7

Ancillary service

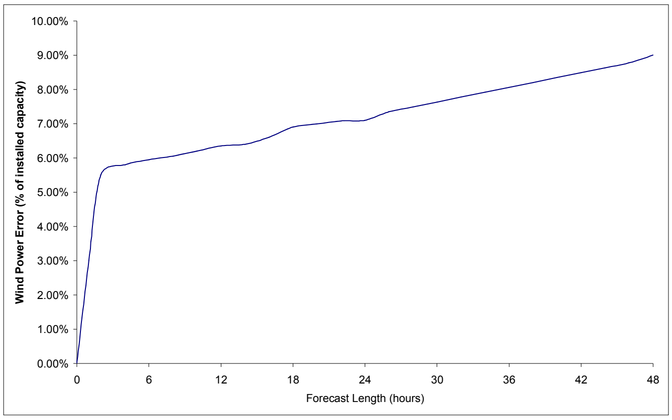
- PHPs can be used as secondary and tertiary reserve too
- Wind producers MC is around zero -> they will always produce, when they can
- The amount of electricity production at a wind farm can not be forecast with absolute certainty
- „Could we increase wind energy penetration only by building pumped storages?"

8

Wind energy I.

REKK Regional Centre for Energy Policy Research

Forecast error in flat terrain



Source: Giebel et al.:Forecast error of aggregated wind power, 2007

9

Wind energy II.

REKK Regional Centre for Energy Policy Research

- If they should give a schedule then in t – 3 hour 1000 MW installed wind capacity in Hungary needs only 60 MW secondary reserves
- These reserve should be bought in a transparent, competetive market

⇩

Pumped storage is only one participant in this market
and not sure that it is the cheapest one

10

Best practice regulation

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- Non-weather dependent producers can give and keep a generation schedule -> can react flexible to energy price
- Gate closure: As close to the real time as it possible (t – 1 hour)
- Wind generators also have to give a generation schedule
- Wind generators have to pay the balancing energy cost, which motivates them to keep the schedule

⇩

It needs a balancing market!

- The cost of the extra secondary reserve requriement should not be paid by wind producers (e.g. Paks does not pay the tertiary reserve)

11

Conclusion

REKK Regional Centre for Energy Policy Research

- If introducing best practice regulations, there will be no such system problems that need the building of pumped storages
- If there is a transparent balancing market, reserve market and a day-ahead market, and pumped storages are profitable (if the balancing energy price is high enough), then PHSs will be built by private investors
- The state has no reason to support such pumped storages

12

REKK REGIONAL CENTRE FOR ENERGY POLICY RESEARCH

THANK YOU FOR YOUR ATTENTION!

REKK was established at the Corvinus University of Budapest in December, 2003. The mission of REKK is to contribute to the creation of working energy markets and the establishment of efficient regulation by carrying out applied research, training and quality consultancy activities for all those interested persons and organizations that are active in the field.

We think that the experiences that Hungary and some other Central and Eastern European countries have gained through the restructuring and re-regulation of their energy markets are valuable and relevant for all transition economies. This is why the Centre intends to put a special emphasis on the research and dissemination of the regional experience and intends to become a regional research and training centre.

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Effects of large-scale increase of RES-E with the focus on the spot market price levels in the Nordic Power system

Göran Koreneff
Hannele Holttinen
Tiina Koljonen

Business from technology

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Effects of large-scale increase of RES-E with the focus on the spot market price levels in the Nordic Power system

- VTT very briefly
- Nordic Power System (http://www.nordel.org/Content/Default.asp)
  - Nordic area
  - transmission lines, exports and imports
  - capacities and productions
- Nordic spot market (NordPool Elspot http://www.nordpool.com/)
- Regulating power market and balance settlement
  - wind power and balance settlement, case calculations
- Large-scale increase of renewables to the Nordic market
  - EU 20% renewables by 2020
  - Effect on spot price level, NEP –modelling results (http://www.nordicenergyperspectives.org/)

2

VTT Technical Research Centre of Finland

VTT IS

- the biggest multitechnological applied research organisation in Northern Europe

VTT HAS

- polytechnic R&D covering different fields of technology from electronics to building technology
- clients and partners: industrial and business enterprises, organisations, universities and research institutes

VTT CREATES

- new technology and science-based innovations in co-operation with domestic and foreign partners

- Established 1942
- Turnover 232 M€
- Personnel 2,740
- 76% with higher academic degree
- 5,730 customers

Facts about the Nordic countries 2006

		Denmark	Finland	Iceland	Norway	Sweden	Nordel
Total area	1,000 Sq. km	43	338	103	324	450	**1258**
Average population	mill. inh.	5,4	5,3	0,3	4,7	9,1	**24,8**
Gross domestic product							
Total 2006*)	bill. USD	176,5	145,7	10,7	190,2	283,9	**807,0**
Per capita	USD	32 685	27 491	35 667	40 468	31 198	**32 540**
Total consumption							
Total 2006	GWh	36 392	90 111	9 925	122 572	146 366	**405 366**
Per capita	kWh	6 739	17 002	33 083	26 079	16 084	**16 345**

*) Estimation by OECD.

Source: Nordel annual statistics 2006

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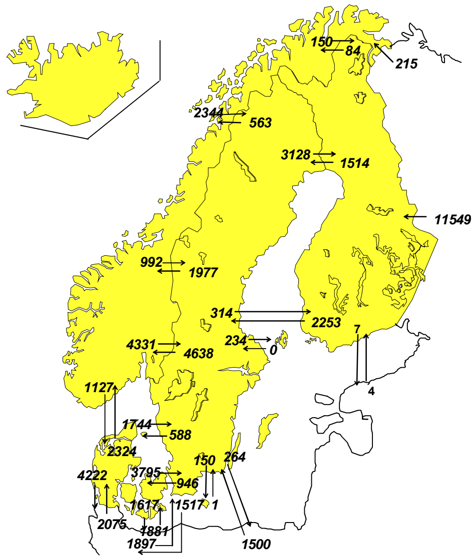

Nordic area and cross-border transmissions (Nordel = organisation of Nordic TSOs)

Imports and exports 2006 in GWh

5

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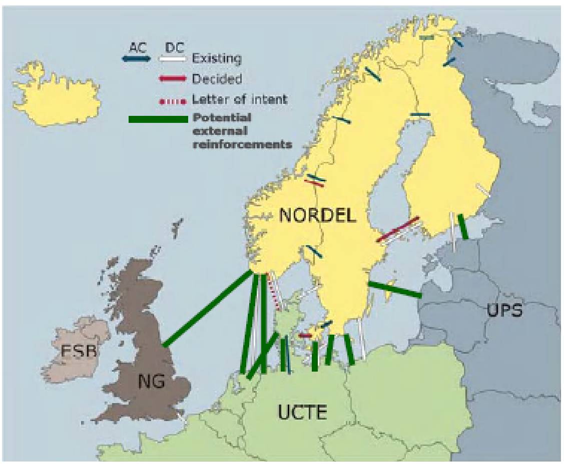
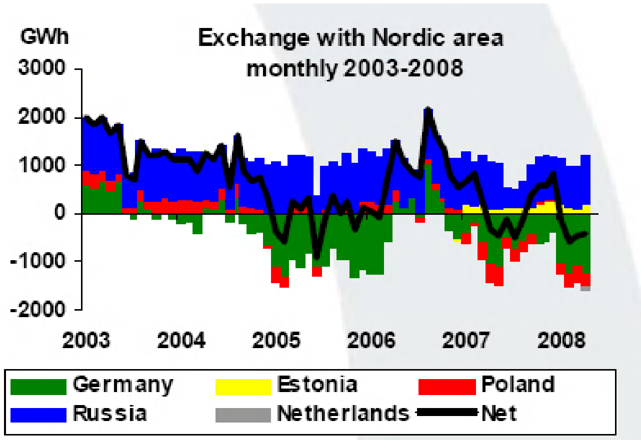
Planned and potential new cross-border transmission lines



- Coming improvements to the market
- Germany
- Reducing congestions

6

Dynamics of Nordic imports and exports



Installed net capacity by production types on 31 December 2006, MW
(source: Nordel)

	Denmark	Finland	Iceland	Norway	Sweden	Nordel
Installed capacity total [1]	**12 699**	**16 544**	1 707	**29 268**	**33 819**	94 037
Nuclear power	-	2 671	-	-	8 965	11 636
Other thermal power	9 554	10 743	113	244	8 094	28 748
- Condensing power	993 [2]	3 301	-	0	2 298	6 592
- CHP, district heating	7 687	3 737	-	131	2 954	14 509
- CHP, industry	567	2 924	-	49	1 229	4 769
- Gas turbines etc.	307	781	113	64	1 613	2 878
Hydro power	10	3 044	1162	28 691	16 180	49 087
Wind power	3 135	86	-	333	580	4 134
Geothermal power	-	-	432	-	-	432
Mothballed [3]	0	0	0	0	500	500

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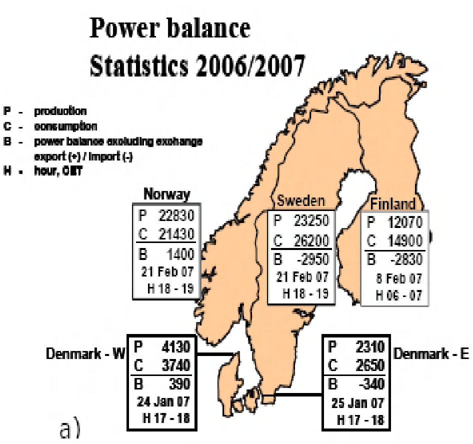
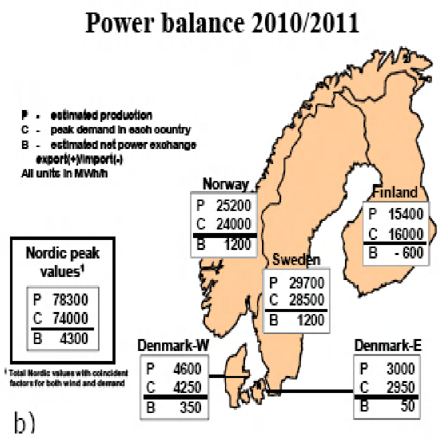
Power balance in the Nordic countries
(source: Nordel)





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Total electricity generation by energy source and net exchange of electricity 2006, TWh
(source: Nordel)

2006	Denmark	Finland	Norway	Sweden	Nordic
Total generation	**43,2**	**78,6**	**121,7**	**140,3**	**383,8**
Total thermal power	**34,6**	**55,9**	**0,4**	**68,8**	**159,7**
- Nuclear power	-	22	-	65	87
- Other thermal (fossil)	34,6	33,9	0,4	3,8	72,7
- Coal	25,8	16,1	-	1	42,9
- Oil	0,1	1,8	-	1,2	3,1
- Peat		6,2	-	0,1	6,3
- Natural gas	8,5	9,8	0,4	0,9	19,6
- Others	0,2	-	-	0,6	0,8
Total renewable power	**8,6**	**22,7**	**121,3**	**71,5**	**224,1**
- Hydro power	0	11,3	119,9	61,2	192,4
- Other renewable power	8,6	11,4	*1,4*	10,3	31,7
- Wind power	6,1	*0,2*	0,7	1	8
- Biofuel	0,8	*10,1*	0,4	8,2	19,5
- Waste	1,7	*1,1*	0,3	1,1	4,2
- Geothermal power	-	-	-	0	
Net imports	**-6,9**	**11,5**	**0,9**	**6,1**	**11,5**

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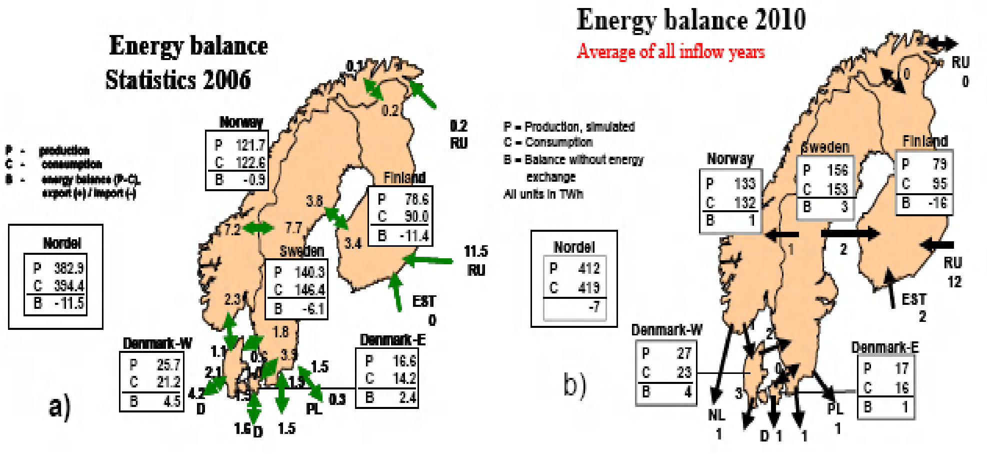
Energy balance in the Nordic countries

(source: Nordel)



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Nordic power market

- Historically hundreds of utilities in Norway, Sweden and Finland
- Plentitude of producers: hydro, DH-CHP, ind-CHP
- Generation, distribution, and retail sales separate entities

- Markets opened for end-users in the 90's, Elspot started in mid-90's
- Common market place in Nordic countries => NordPool, Europe's largest and leading marketplace for power
  - spot market Elspot
    - 291 TWh, 69% market share
    - congestion => split into price areas
  - aftermarket Elbas (after spot, up until 1 hour before)
  - fiscal contracts Eltermin, based on spot price notations
  - intra-Nordic transmission, cross-border commercially managed by NordPool
- Common balance market in Nordic countries

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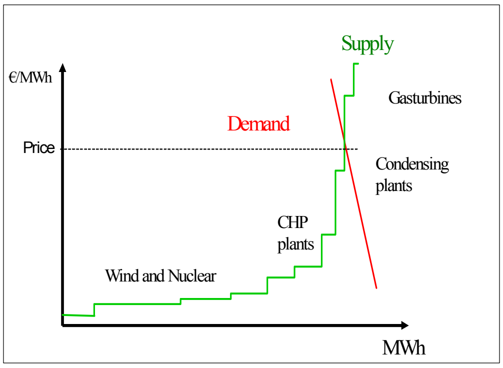
NordPool Elspot

- day-ahead market
- producers and consumers give bids 12 to 36 hours in advance
  - quantities (in steps)
  - corresponding price for the steps
- for each hour, the price that equalises supply with demand is determined => all trade is done to this price



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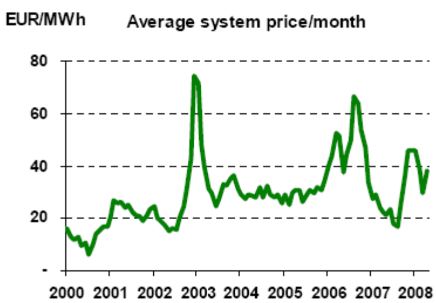
Elspot price development, elspot price areas



- Congestion => split into price areas
  - Helsinki (Finland)
  - Stockholm (Sweden)
  - Copenhagen (Denmark East)
  - Århus (Denmark West)
  - Oslo, Trondheim,... in Norway

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Regulating power market

- Common Nordic regulating power market unless congestions
- TSO responsible, always the other party in each deal
- Secondary reserves (15 min)
- Minimum bids 10 MW
- Highest accepted upregulation bid => upregulation price for that hour
- In Nordel, two systems in use:
  - Two-price model (used e.g. in Finland and Sweden, and in the examples later). No one is allowed to profit from imbalance compared to area spot price.
  - One-price model (in use in Norway)
  - Difference in how the producers are paid during the hours when the error has been opposite to the net imbalance of the power system: one-price model lets the producer gain extra during those hours
- One-price model very good for wind power producers:
  - As long as wind power is not dominating the power system imbalance, the error will be about half and half contributing to the imbalance and helping the system → one-price model: no extra cost!
  - When wind power penetration level is high (Denmark), wind power producers will start to pay penalties when they start to influence the system net imbalance

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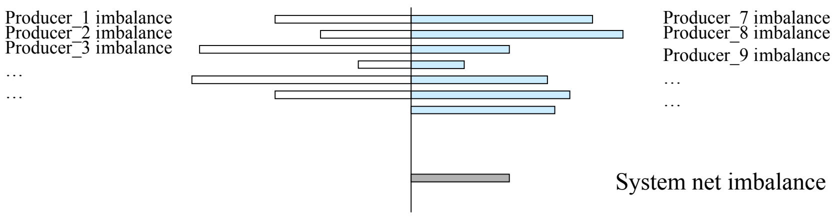
Balance settlement rules - example



- Regulating power market is used to cover the system net imbalance → price for imbalances of that hour
- System operator charges regulating power price for imbalances from all producers that have had their imbalance in the same direction as the regulation need
- The producers that have had their imbalance in the opposite direction
  - pay/receive the spot market price for the imbalance (two-price model)
  - pay/receive the regulating market price (balancing fees are circulated; one-price model)

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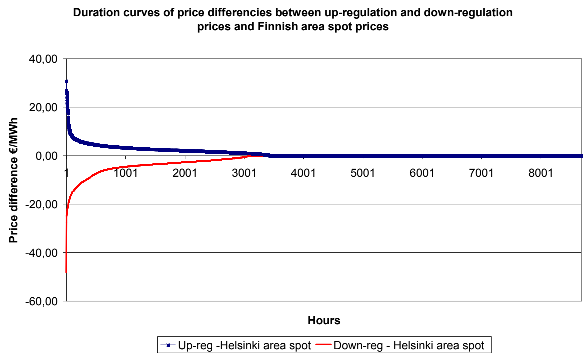
Market prices in 2004

- Average spot price
  - Finland 27.70 €/MWh (System price 28.95 €/MWh if no bottlenecks)
- Prices for regulation power market
  - no extra price for 25 % of time in 2004
  - Additional price for up-regulation 2.87€/MWh (for the hours when up-regulation price differs from spot price)
  - Price reduction for down-regulation 4.65€/MWh (for the differing hours)



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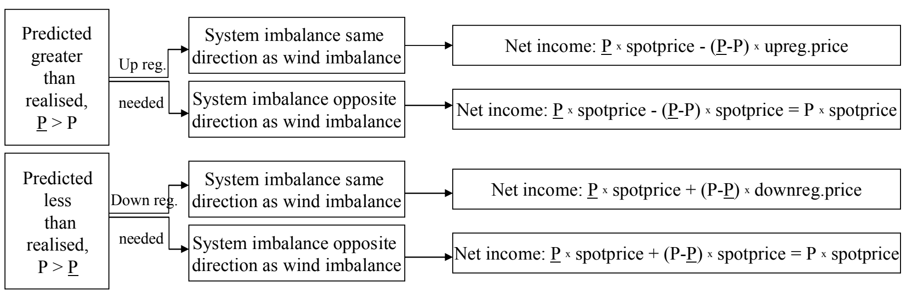
Electricity market - calculating income for wind producer

- Bids to the spot market at noon the previous day:
  - Income = spot price × predicted production
- Imbalance due to misprediction settled at regulation market prices: cost or income for imbalances = regulation price times prediction error
  - price for regulation only for direction of system imbalance
  - If wind imbalance to opposite direction → paid according to spot price



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Balancing costs for wind power, year 2004 Finland

	1 site	4 sites 380 km		12 sites 600 km
	Time series	Average forecast*	Time series	Time Series
Pred. error: % prod. Pred. error: % time	50.8 100	73.7 100	40.8 100	30.9 100
Error up: % prod. Error up: % time	24.9 55.9	36.9 58.7	24.9 62.9	17.5 60.5
Error down: % prod. Error down: % time	25.9 44.1	36.8 41.3	15.9 37.1	13.4 39.5
Up-reg. cost: % prod. Up-reg. cost: % time Up-reg. cost: €/MWh_{reg}	10.2 22.3 2.96	14.8 23.7 2.88	10.5 25.3 3.03	6.9 23.7 3.09
Down-reg, cost: % prod. Down-reg, cost % time Down-reg, cost €/MWh_{reg}	9.1 15.6 4.21	14.3 15.3 3.99	5.7 13.4 4.03	5.0 14.1 3.84
Spot price no error €/MWh	27.63	27.68	27.68	27.68
Balancing cost €/MWh_{prod}	0.69	1.00	0.55	0.40
Fixed payment (0.7 €/MWh_{reg})	0.36	0.52	0.29	0.22
Balancing cost total €/MWh_{prod}	**1.05**	**1.52**	**0.84**	**0.62**
Net income €/MWh	26.58	26.16	26.84	27.06

*Average forecast means not using any forecast model but simply 200 kW in summer and 300 kW in winter for all hours ahead

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Impact of wind power to the balancing settlement of the actor

- Comparisons made:
  - Combine wind power and load imbalances
  - Combine wind and hydro power imbalances
  - Combine wind and thermal power imbalances
  - Combine wind and the whole imbalance of the actor
- How different amounts of wind power show in the imbalances

- Roughly half the time the imbalances compensate each other reducing the net balance requirements
- wind power 10 % of peak load → wind power balancing costs would reduce to about 36 %
- wind power 10 % of thermal capacity → wind power balancing costs would reduce to about 60 %

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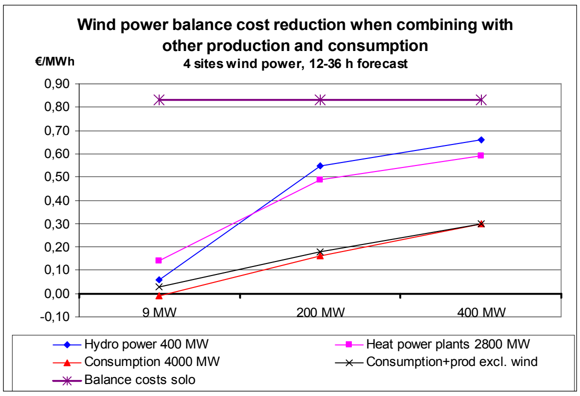
Combining wind imbalances with other production and load

VTT 12-36h forecast €/MWh$_{prod}$	*NET Balance cost for 4 sites* 9 MW	200 MW	400 MW
Hydro power 400 MW	0,06	0,55	0,66
Heat power plants 2800 MW	0,14	0,49	0,59
Consumption 4000 MW	-0,01	0,16	0,30
Consumption+prod excl. wind	0,03	0,18	0,30
Balance costs solo	0,83	0,83	0,83



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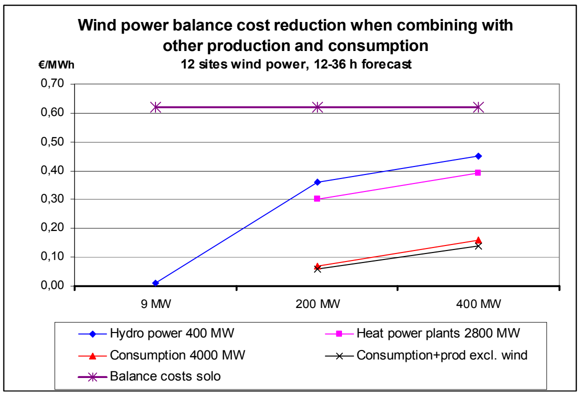
VTT TECHNICAL RESEARCH CENTRE OF FINLAND

Combining wind imbalances with other production and load

VTT 12-36h forecast €/MWh$_{prod}$	*NET Balance cost for 12 sites* 9 MW	200 MW	400 MW
Hydro power 400 MW	0,01	0,36	0,45
Heat power plants 2800 MW		0,30	0,39
Consumption 4000 MW		0,07	0,16
Consumption+prod excl. wind		0,06	0,14
Balance costs solo	0,62	0,62	0,62



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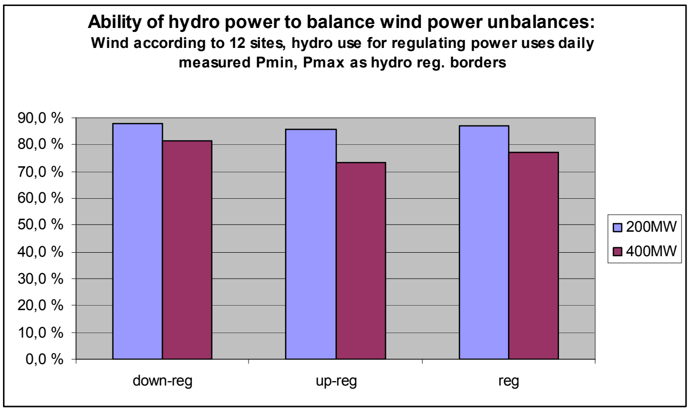
Using the hydro power regulating capacity of the producer

- Estimating the flexibility of the hydro power
  - Taking the daily Pmax, Pmin for the hydro power production – regulating capacity within Pmin and Pmax
  - Checking that daily production do not differ from schedule
- Result:
  - 80-90% of wind power imbalances can be regulated using these limits

Using the hydro power regulating capacity of the producer



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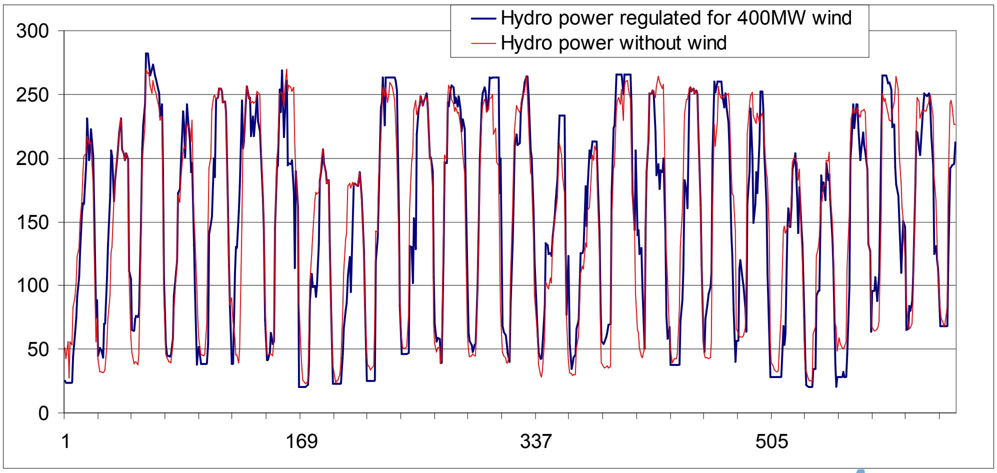
Using the hydro power regulating capacity of the producer



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Large-scale increase of RES-E in the Nordic power system

- EU Renewable energy sources (RES) 20% by 2020
  - Finland RES share from 28.5% to 38% by 2020
  - Sweden
  - Denmark
- Nordic Energy Perspectives –project
  - several models, with both exogenous and endogenous new capacity
  - results from VTT's Electricity market model (VTT-EMM)
    - exogenous capacity development
    - result is spot price (NOT production price, or average cost, ...)
- Electricity from RES (RES-E), targets?
  - three scenarios for increase in RES-E
    - 6%, 12% and 18% => increased RES-E share respectively of 2, 6, and 9.5 %-points

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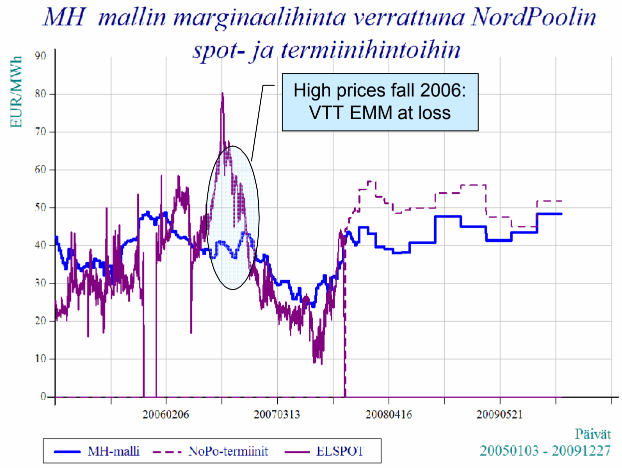
VTT EMM (Nordic system price model) in action: price estimate 2005-2009, compared to realised system price and forward prices (from fall 2007)



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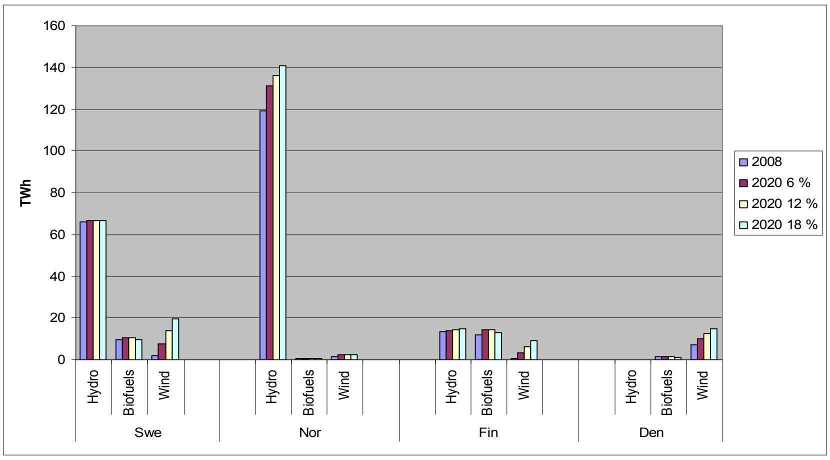
Renewables in the Nordic system 2008 -> 2020



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GW		2007	2010	2020	2030
Nuclear power	Swe	9,2	9,5	10,1	10,1
	Fin	2,7	2,7	5,9	5,9
Gas power	Nor	0	0,904	0,904	0,904

- Other general NEP2 assumptions
  - Sweden nuclear capacity factor 91%, a significant increase from roughly 81%...85%
- Hydro, wind capacity increases roughly from ECON Classic model results (endogenous model)
- Demand 440 TWh by 2020, a 10% increase

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			2007	2010	2020	2030
Natural gas	EUR/MWh	Swe	18	24,2	19,2	20,2
	EUR/MWh	Nor	14	20,2	15,2	16,2
	EUR/MWh	Den	18,1	24,2	19,2	20,2
	EUR/MWh	Fin	16,1	22,3	17,3	18,3
Coal	EUR/MWh		8,88	9,09	5,93	6,22
Crude oil	$/barrel			57,7		62,4
Light fuel oil	EUR/MWh		37,7	41,8	32	33,3
Heavy fuel oil	EUR/MWh		19	20,7	16,6	17,2
Wood chips	EUR/MWh	Swe	16	18	20	20
	EUR/MWh	Nor	16	18	20	20
	EUR/MWh	Den	16	18	20	20
	EUR/MWh	Fin	12	15	20	20
	EUR/MWh					
Peat	EUR/MWh	Swe	13	13	14	15
	EUR/MWh	Fin	8	8	9	9

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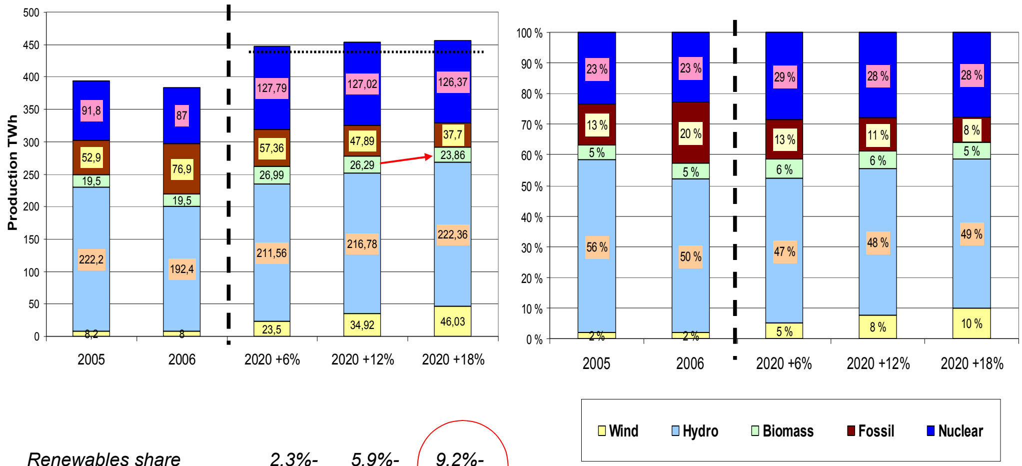
VTT EMM: Nordic countries, 30 euro/tCO2



Renewables share increases with:	*2,3%-units*	*5,9%-units*	*9,2%-units*
Fossil electricity decreases from 2006 with:	25 %	38 %	51 %

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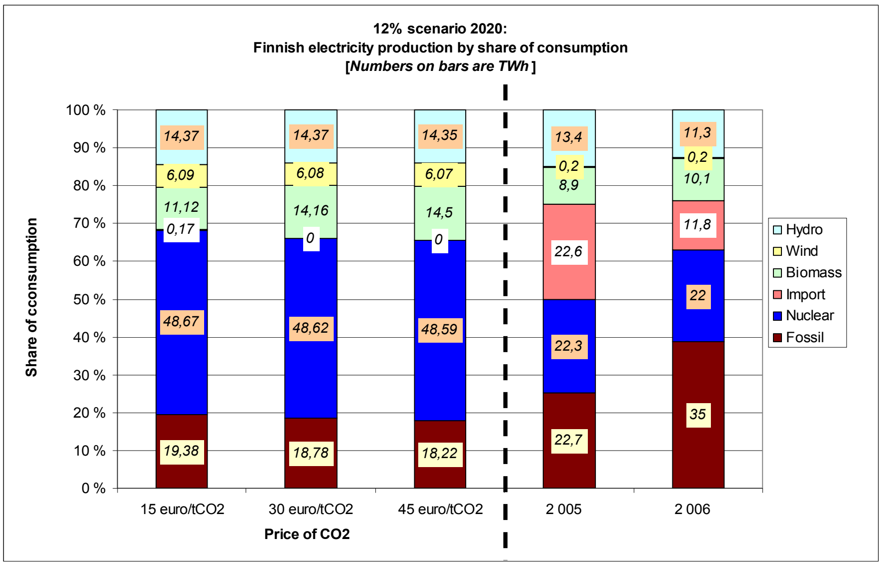

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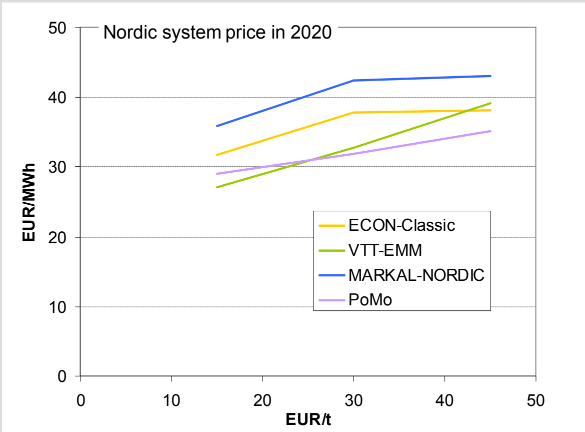
EU ETS

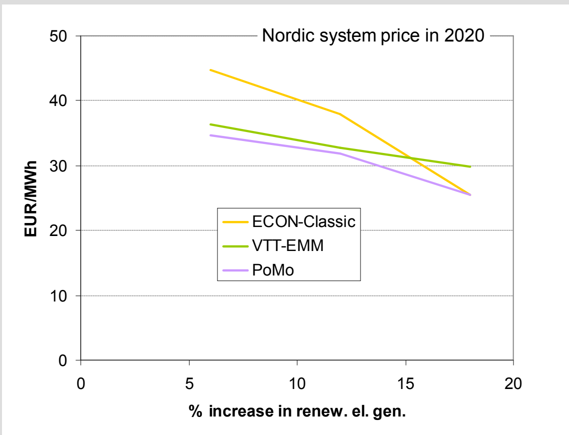


Wholesale electricity price in the Nordic market vs. the EUA price (results from four different models).

33

VTT TECHNICAL RESEARCH CENTRE OF FINLAND

Renewables target



Wholesale electricity price in the Nordic market vs. the increase in renewable electricity generation (results from three different models).

34

VTT TECHNICAL RESEARCH CENTRE OF FINLAND

VTT extra scenarios for assessing the influence of renewables on the Nordic system price

- Capacity development is congruent with NEP2 6% scenario, but:
  - Norway wind 1400 MW, thus 600 MW more
  - Swedish nuclear still 10 100 MW, but capacity factor is lower, on the level of recent years
- Partly different fuel prices than in NEP2, among others:
  - coal 10 €/MWh
  - biomass (not black liquor) 15 €/MWh
  - stable real fuel prices

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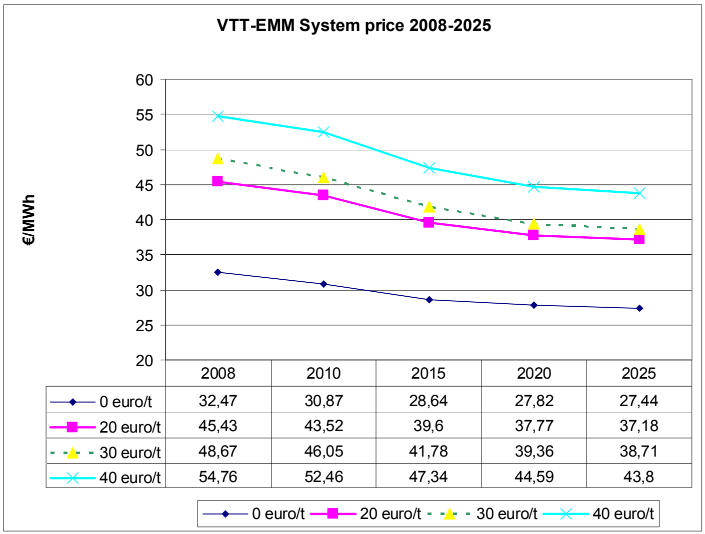
VTT TECHNICAL RESEARCH CENTRE OF FINLAND

Price development in VTT scenarios



	2008	2010	2015	2020	2025
0 euro/t	32,47	30,87	28,64	27,82	27,44
20 euro/t	45,43	43,52	39,6	37,77	37,18
30 euro/t	48,67	46,05	41,78	39,36	38,71
40 euro/t	54,76	52,46	47,34	44,59	43,8

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The latest issue with RES-E development in the Czech Republic

Rostislav Krejcar
The Czech Energy Regulatory Office
Electricity Department

21st May 2008, Budapest

1

Main principles of renewable energy support

ERU Energy Regulatory Office

Act No. 180/2005 Coll. on renewable energy support

- **renewable energy producers have priority access right to electricity grid**
- **producer can choose between two types of support**

Fixed feed in tariff

- buyer is a distribution or a transmission company
- 15 years payback period of investments is guaranteed
- price adjustments related to inflation
- not apply to electricity from combined fossil fuel and biomass combustion

Green bonuses

- buyer is a trader or a customer
- distribution or transmission company pays green bonus to producer
- no long- term price guarantees
- higher risk for producer but higher profit possible

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2

Main support scheme for RES-E

Other Legal Provisions I

ERU Energy Regulatory Office

Decree No. 475/2005 Coll., (revision in 2007)

- sets procedures and timeframes for producers to choose between feed-in tariff and bonus
- contains main typical technical and economical parameters as an input for price calculations:
  - Specific investment costs of technologies per kW
  - Utilization period at maximum capacity of the unit
  - typical lifetime of each technology
  - Last revision of parameters in 2007 for new installations

Decree No. 150/2007 Coll., about price regulation procedures

- prices for RES-E are adjusted annually according to the inflation from 2% up to 4%
- Prices are guaranteed for typical lifetime of each technology

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Main support scheme for RES-E

Price decisions

ERU Energy Regulatory Office

Feed-in tariff system in price decisions has been employed since 2001 (before RES-E act in 2005)

- **Feed in tariffs are set as minimum electricity purchase prices**
  - **no price reduction with regard to deviations** - responsibility of deviation is transferred to a distribution or transmission company
- **Bonuses are set as fixed prices**
  - **responsibility for deviations is subject of an agreement between producer and trader** – no bonus reduction either
- **Prices are published in the ERO Price Decision:**
  - **annual update of minimum prices**
  - **prices are differentiated by the type of a renewable source and its commissioning date**
  - **more than 30 categories of prices exist in 2008**
- **Extra bonus for renewable cogeneration electricity**

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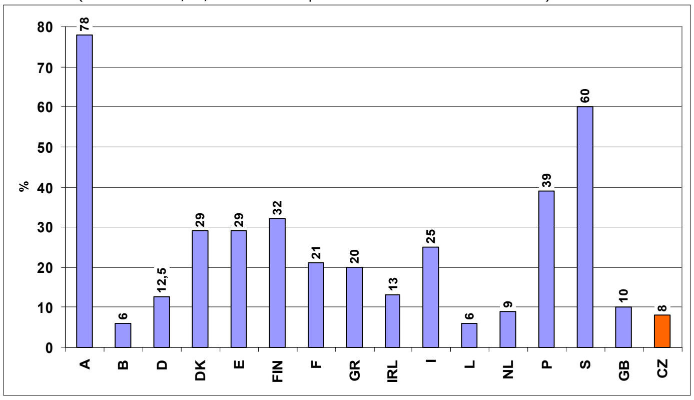
EU Indicative Targets for Power Generation from Renewables in 2010

ERU Energy Regulatory Office

(Directive 2001/77/EC of the European Parliament and of the Council)



Czech Republic

Share of renewable electricity on gross national consumption %	2003	2004	2005	2006	2007
	2,67	3,97	4,34	4,97	4,69

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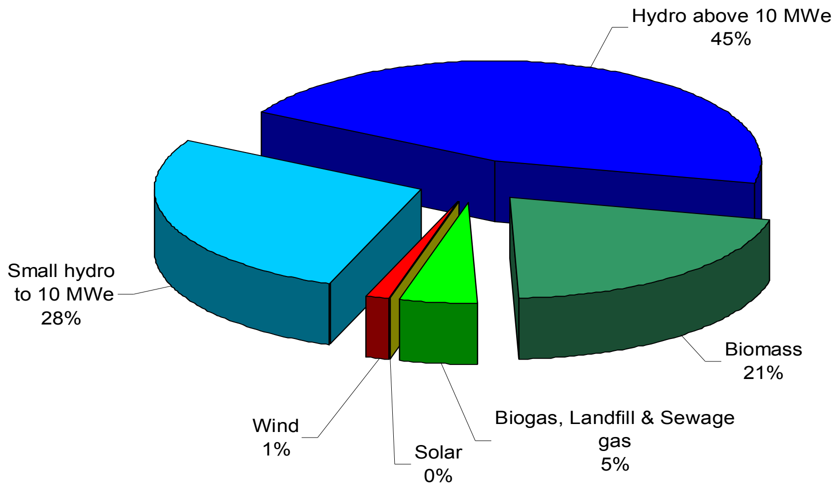
Share of different types of Renewables in 2006 in CR

ERU Energy Regulatory Office



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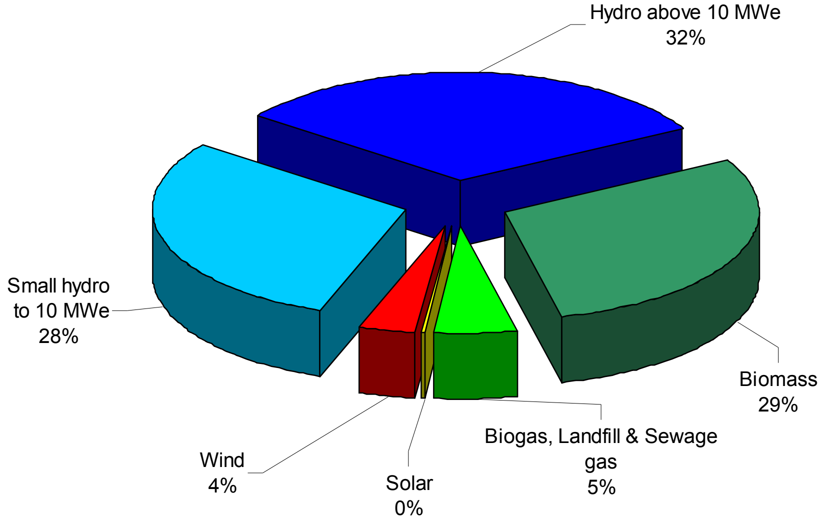
Share of different types of Renewables in 2007 in CR

ERU Energy Regulatory Office



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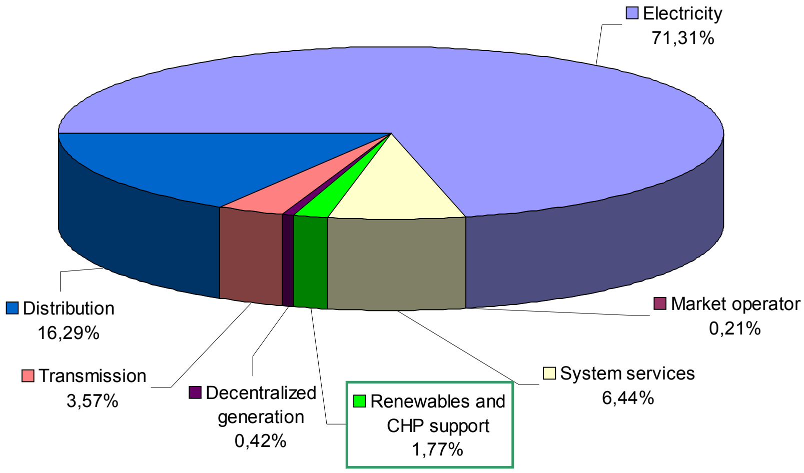
Impact of RES support on end customers

ERU Energy Regulatory Office

Share of price components on average household price in 2008 (without VAT)



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Problems resulting from RES-E development

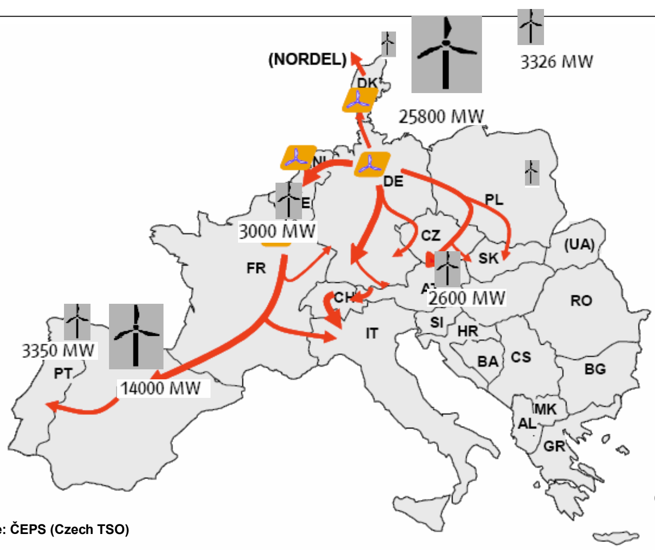
Impact on prices paid by end customers

- increasing costs for end customers (difference between market price and support)
  - 2002 24mil. EUR
  - 2008 76 mil. EUR

Security and reliability of supplies

- increasing deviations and cost for deviation management
  - influences structure and utilization of balancing energy
- need for new reserve capacities
  - estimated extra cost in 2010 (800 MW in wind) 115mil EUR

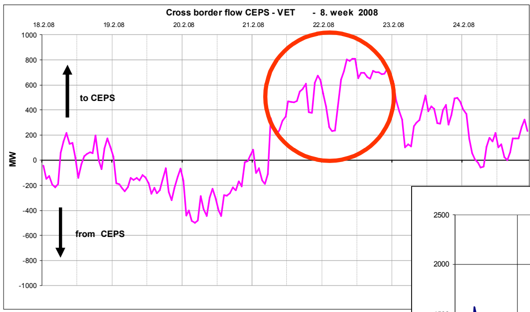
Problems resulting from RES-E development – not only national problem



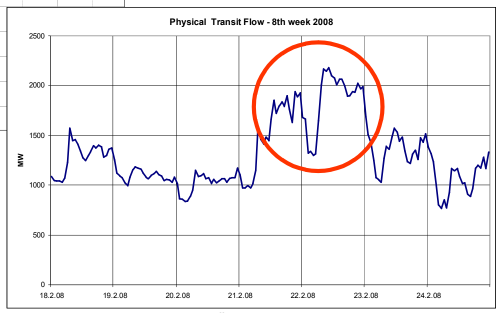
Source: ČEPS (Czech TSO)

Influence of wind power distribution on international tradable capacities

ERÚ Energy Regulatory Office



Source: ČEPS (Czech TSO)



Source: ČEPS (Czech TSO)

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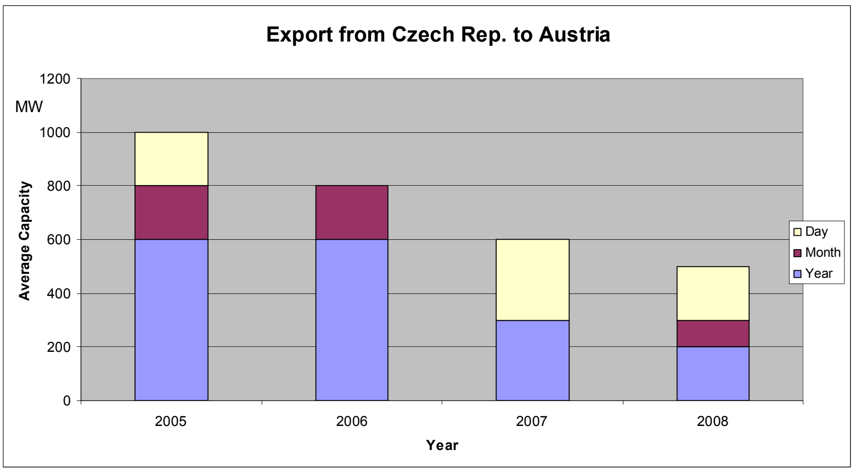
Influence of wind power distribution on international tradable capacities

ERÚ Energy Regulatory Office



Source: ČEPS (Czech TSO)

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Thank you for your attention
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Renewable Energy Sources in Romania – Elements of the proposed RES legislation

Dan I. Teodoreanu

"Integration of more Renewable electricity in the CEE region: network or support problem?" Budapest, Hungary, 20 – 21 May 2008

Summary

I. RES Potential Romania

II. Legal framework in the field of RES
Present and future

III. R&D Programs/Structural and Cohesion funds

IV. Practical aspects –wind energy

V. NESL–ICPE Romanian RES Working Group

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I. RES Potential (1)

RES Type	***Potential Annual (kToe)***	***Energy***
Solar energy	3430 516	Thermal Electric
Wind energy	1978	Electric
Hydro Total: P< 10MW	3448 310	Electric Electric
Biomass	7814	Thermal Electric
Geothermal energy	215	Thermal

Technical Potential of RES in Romania (2006)

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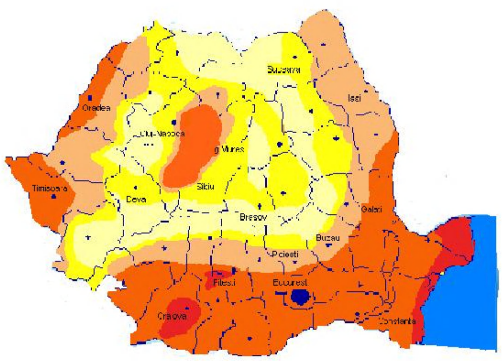
I. RES Potential (2)



ZONA DE RADIATIE SOLARA	INTENSITATEA RADIATIEI SOLARE(kWh/m²/an
I	>1350
II	1300-1350
III	1250-1300
IV	1200-1250
V	<1200

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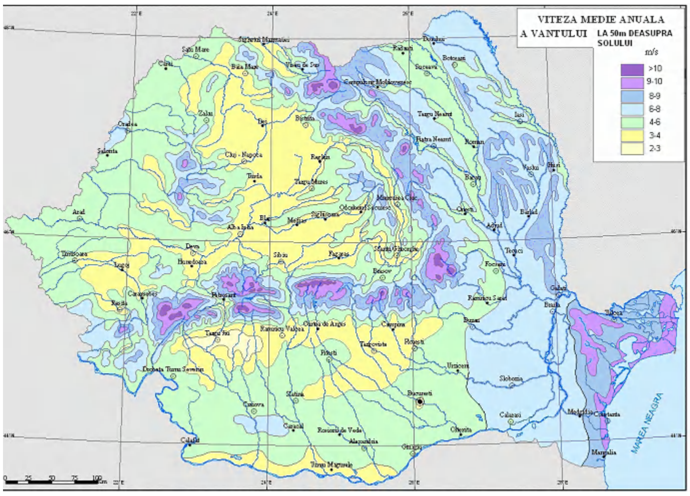
I. RES Potential (3)



II. Legal framework in the field of RES (1)

Primary legislation:

- **"The Electricity Law"** No.13/2007
- **GD** (Government Decision) No.1535/2003 – **"National strategy for RES (Renewable Energy Sources) Use"** (similar with EU White Paper for RES (1997)
- **GD** No. 443/2004 – "**Promotion of the electricity produced from RES"** (similar with EU Directive 177/2001)

II. Legal framework in the field of RES (2)

Quota/green certificates:

- **GD No.1429/2004: "Certification rules for the origin of power supply produced by RES"**

- **GD No. 1892/2004 and No.958/2005: regarding the "System established to promote electricity generated from renewable energy sources"**

II. Draft proposal for RES Law: "The system for RES promotion" (1)

Approved by Parliament (Senate) on 8.04.2008

Some important differences compared to GD 1892/2004:

- **Values of the 1 Green Certificate (GC)**
- **Duration of the validity of the regulation**
- **Private persons considered as RES producers**
- **International participation to the market**

II. Draft proposal for RES Law: "The system for RES promotion" (2)

1. All new installed RES: 1 GC ⇒ 1 MWh
   For PV applications: 1 MWh ⇒ 3 GC
   For old RES hydro generators 1 MWh ⇒ ½ GC
2. The duration of the present law regulations:15 years
3. Maximum value for 1 GC ⇒ 60 Euro, instead of 42 Euro
4. Proposed time of application: 1 May 2008

II. Draft proposal for RES Law: "The system for RES promotion"(3)

The other quotas (without big (>10 MW) hydro):

2005	2006	2007	2008	2009	2010	2011	2012
0,7	2,22	3,74	5,26	6,78	8,3	8,3	8,3

For the period 2012 - 2020 the formula will be used:

Q= (Eres1 + ½ • Eres2 + 3 • Eres3)/EE •100/year

where:

Eres1 = energy from new installed RES
Eres2 = energy from old RES
Eres3 = energy from solar E - RES
EE = total electric energy production

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II. Romanian Energy Strategy for 2007 – 2020 (1)

The main objectives:

- **Sustainable development**
- **Competitiveness**
- **Security of Supply**

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II. Romanian Energy Strategy for 2007 – 2020 (2)

Sustainable development

- Promotion of RES - E: from total energy consumption
  - 33% - 2010
  - 35% - 2015
  - 38% - 2020
- Promotion of: biofuels, biogas
- Promotion of R&D in RES fields
- Promotion of green RES

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II. Romanian Energy Strategy for 2007 – 2020 (3)

Competitiveness:

- Development of market instruments for: electrical energy, natural gas, coal, oil, uranium
- Development of instruments like: green certificates, certificates for Green House Gas Emission and for energy efficiency
- Extension of the activities of the Romanian Operator of Central Market for electrical energy - OPCOM at regional and European level
- Increased capacity of interconnection to international electricity transport networks (from 10 to 15 – 20%) in 2020

II. Romanian Energy Strategy for 2007 – 2020 (4)

Electricity production	**TWh/year**	**%**
Hydro+RES	16.	25.5
Nuclear	7.0	11.1
Coal	28.7	45.8
Gas	9.5	15.1
Oil	2.0	2.5
Total	63.2	**100**

II. NEW TARGETS

-Present situation2007: Primary energy consumption = 30MToe,Electrical energy total = 5.44MToe = 63.2TWh, RES = 3MToe, 10% from the total consumption

-RES Technical Potential = 17.71MToe(60% from 2007 consumption)

Application of the new EU Directive from 23 January 2008

✓The contribution of the RES in the total Energy consumption in Romania will grow from 17.8% in 2005 to 24% in 2020

Correlation with the hydropower energy

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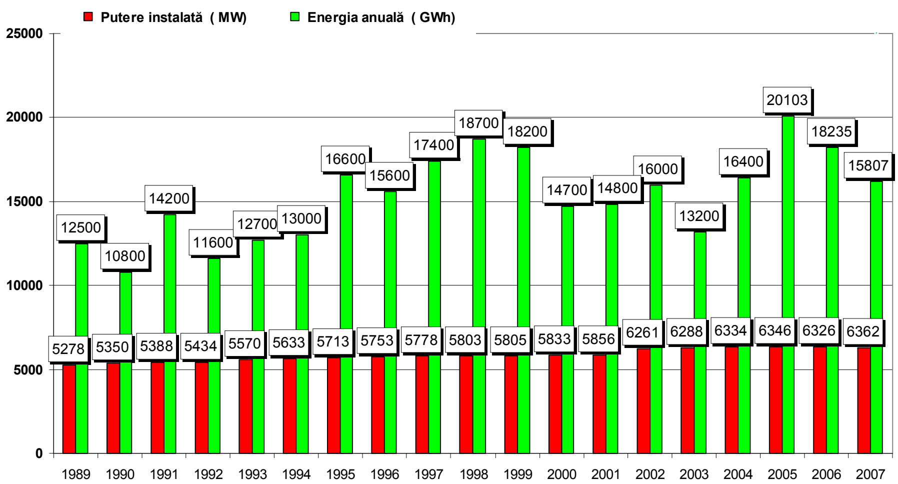
NEW TARGET



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III. Wind energy – Integration into the grid

Topics:

- Wind energy perspectives
- Existence of many projects of wind parks
- Time variation of the parameters of electricity generated in wind parks
- Problems for the transport company *Transelectrica*:
  - hourly integration of the wind energy
  - good average system integration

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III. Wind energy – Integration into the grid

- ***Capacity of connection***
- Number of annual hours of standard generation: **1500 - 2500**
- Variable distance to the consumers
- Wind speed variable in time - difficulty for maintenance
- Time for installation of a new transport network – usually higher than for wind park installation.

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III. Wind energy – Integration into the grid

Present status of wind projects

Installed power: 8 MW

Wind energy projects: 3650 MW

- Dobrogea: 3017.5 MW
- Moldova: 532.5 MW

Transelectrica approvals:

Connection to the High Voltage: 600 MW

ENEL - Dobrogea approvals:

Conection to the medium voltage: 310 MW

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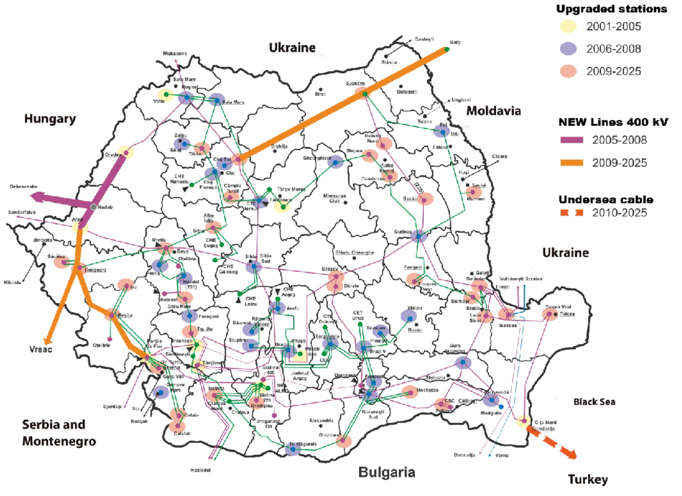
Romanian Electricity Transmission Network



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IV. Research & Development Program (1)

Research & Development Programs funded by Romanian Government – Ministry of Education and Research:

National Program: “Research for Excellence”- based on “Collaborative research” and the EU Technology Platforms already established.

IV. Research & Development Programs (2)

Research activities in the field of RES National Programm:

- Biofuels
- Hydrogen and fuel cells
- Biomass (crops, wood, waste, s.o)
- Marine energy
- Wind technology for small and medium turbines
- Renewable heating
- 2008 Competition: Total number of projects: more than 50
- Total public funding budget: more than 5 million of Euro/year and private - 30% of the total funds.

IV. Structural and cohesion funds (2008 – 2013)

Priority 2: R&DI Projects for investment in infrastructure, innovation and centers of excellence-platforms for research, demonstration and dissemination at EU level

EU Funds (Program Draft): ~ 500 Mill. Euro; Local funds ~ 250 Mill.Euro

***Priority 4*:** *Projects based on RES applications/energy efficiency*: Co-financed by EU - European Regional Development Fund (max. 50% of the total eligible costs) and Romanian Government/Private Companies for the rest.

Total EU funds (Program Draft): ~700Mil.Euro (RES ~ 200 Mill. Euro)

IV. EU funds for rural development & environment

Funds for factory development of RES system components:

2008 -2013: 240 mil.Euro

Value per project = 100 000 – 20 000 000 Euro

V. NESL – ICPE
Center of Excellence for Solar and Wind Energy

• Before 1989, NESL – ICPE (founded in 1981) had the leading position in solar and wind energy in Romania, official partner in joint projects financed and organized at national and international level

• After 1989 NESL - ICPE participated in European co-operation projects: PECO, JOULE THERMIE, INCO-COPERNICUS, FP5 and FP6 Programs (14 EU projects)

• NESL - ICPE is member of EU PV Technology Platform and of the EU TP "*Smart Grid*" - Networks of the Future

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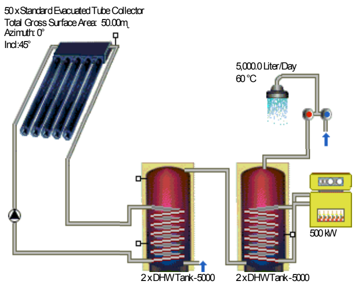
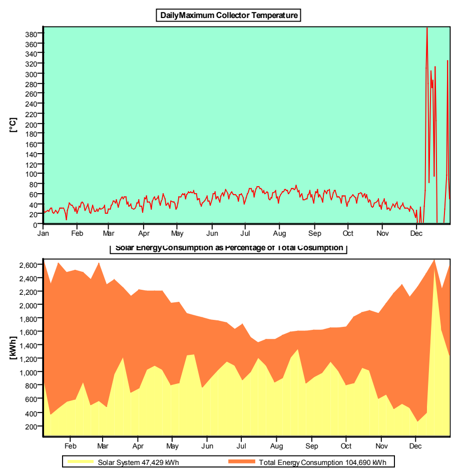
V. NESL – ICPE
Center of Excellence for Solar and Wind Energy

Solar thermal systems





Feasibility studies for solar thermal hybrid systems

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V. NESL – ICPE
Center of Excellence for Solar and Wind Energy

PV/WIND hybrid system

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Quality assessment: indoor and outdoor tests:

- NESL- ICPE has the capability to perform field tests for RES systems and components
- There are three test site facilities: at Agigea and Costinesti on the Black Sea coast, and at Anghelus - in the Carpathian mountains.

ROMANIA MAP

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Feasibility studies for wind parks

Installation of wind measuring systems in Dobrogea and Moldova counties

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Contact:

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313, Splaiul Unirii
030138, Bucharest, Romania
Romanian representative of in the Mirror Group of the EU Technology Platform *Photovoltaics*

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ROMANIAN AGENCY FOR ENERGY CONSERVATION

Renewable Energy Sources and Energy Efficiency in Romania in the light of the EU legislation

Corneliu Radulescu
Romanian Agency for Energy Conservation

EU ENERGY POLICY TARGETS

- *Directive 2006/32/EC (ESD)*

Purpose

Energy efficiency increase in energy end-use sectors, by:

- *providing the indicative targets* as well as mechanisms, incentives and institutional, financial and legal framework necessary for the promotion of efficient energy end-use;
- *creating the conditions for the development and promotion of the* market for energy services

Target

- *Energy savings of* 9% *for the end of the period 2008-2016, respectively 1% per year, of the annual average of the final energy consumption in the last 5 years (period 2001-2005) (the companies under emission trading scheme are excluded)*

↓

National Energy Efficiency Action Plans
Deadlines : 30th June 2007; 30th June 2011; 30th June 2014

• *Integrated Energy and Climate Change Package, January 2007*

Target

• *Reducing GHG by 20% by 2020 comparatively with 1990;*

• *Energy savings of 20% of the EU total primary energy supply by 2020;*

• *Share of the renewable energy of 20% in overall energy mix by 2020, and a minimum target of 10% for biofuels.*

Legislative proposals:

• *Modifying the ETS Directive (2003/87/EC)*

• *Directive proposal on the use of the renewable energy sources*

• *Proposal for establishing the GHG targets for the non-ETS sectors*

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• *Integrated Energy and Climate Change Package (continue)*

Proposal (2008) 85/3 of 23 January 2008

Targets by 2020 for each EU Member State regarding:

• *GHG emission cut ;*

• *Share of the renewable energies in the final energy consumption*

Proposal for Romania:

→ *+19%* *Target on GHG emission for non-ETS sectors*

-21% *Target on GHG emission for ETS sectors*

→ *24%* *Share of RES in final energy consumption*

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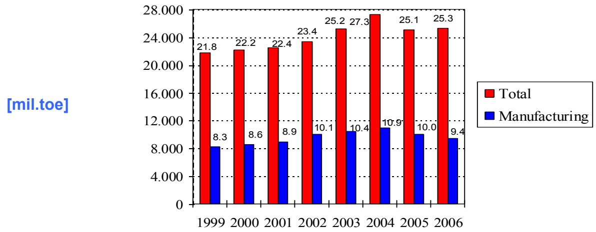
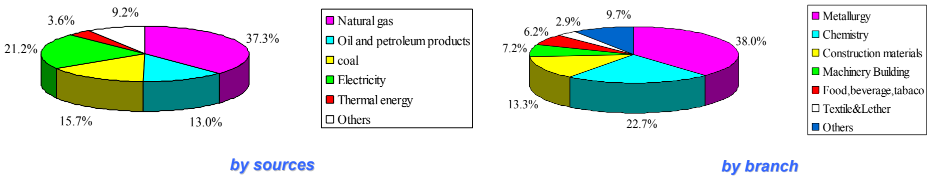
Evolution of the final energy consumption



Structure of final energy industrial consumption in 2006



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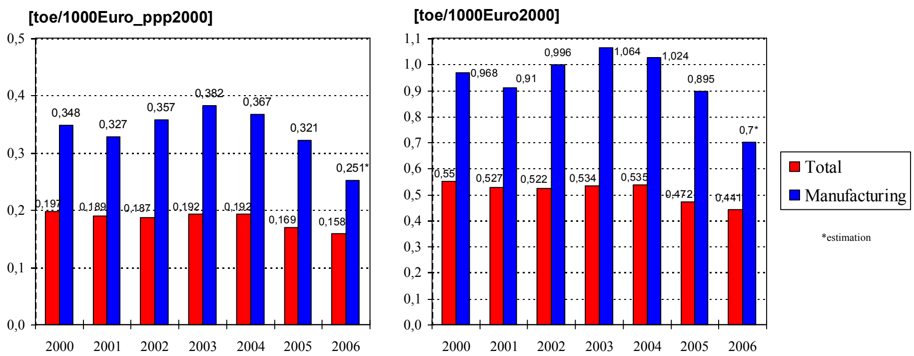
Evolution of final energy intensity



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- ***Strategy for Renewable Energy Sources use (GD 1535/2003) and the promotion of electricity generation from RES (GD 958/2005, updated):***

  Targets:

  – RES share in the total primary energy supply: 11% by 2010;

  – RES share in the gross electricity consumption: 33% by 2010;

  35% by 2015;

  38% by 2020.

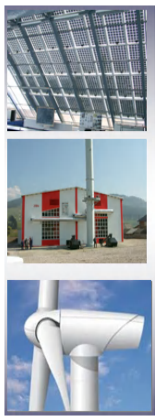
- ***Promoting biofuels and other RES in transport (GD 1844/2005, GD 456/2007)***

  Targets:

  - minimum share: 2% in total in 2007;

  - minimum share: 5,75% in total in 2010.

Renewable Energy Sources in Romania



Within the **"STRATEGY FOR THE UTILISATION OF RENEWABLE ENERGY SOURCES"** is highlighted the energy potential of RES in Romania

RES	Potential (thou toe/year)
SOLAR ENERGY - thermal energy - photovoltaic system	 **1,433** **103**
WIND ENERGY	**1,978**
MICRO HYDRO ENERGY	**516**
BIOMASS	**7,597**
GEOTHERMAL ENERGY	**167**
TOTAL	**11,795**

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National TARGETS

2010: **33%** on the total generated electricity produced from renewable energy sources

2015: **35%**

2020: **38%**

target concerning the share of electricity produced from renewable in the gross internal electricity consumption is: **2,22%** for 2006, **3,74%** for 2007, **5,26%** for 2008, **6,78%** for 2009 and **8,35%** since 2010.

2010: **11%** on the total primary energy sources

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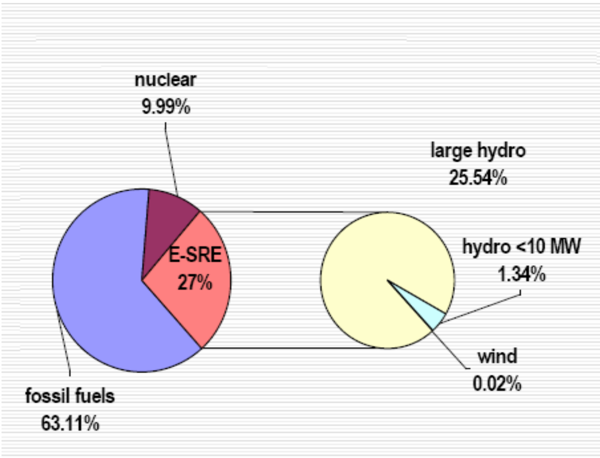
The present share of RES in total energy production



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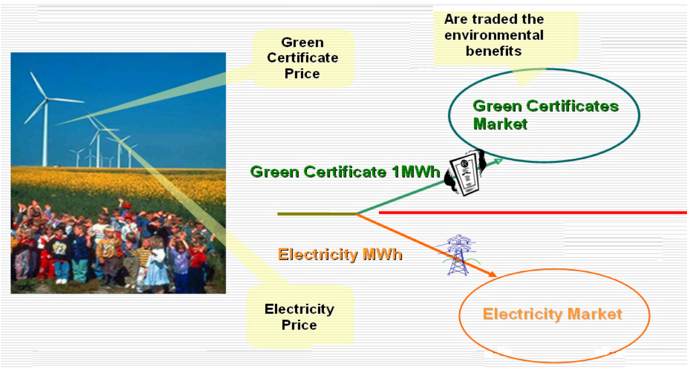
Promotion system of renewable energy sources in Romania



For each MWh of renewable electricity delivered to the grid, producers receive from the System and Transport Operator, **1** green certificate which can be traded for prices between established limits of EUR **24-42/ certificate**

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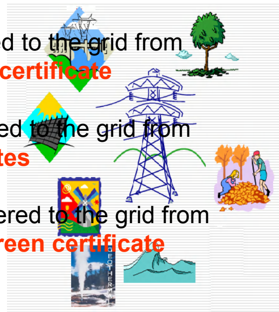
Renewable Energy Sources eligible to receive GC

Draft Project for a G.D.



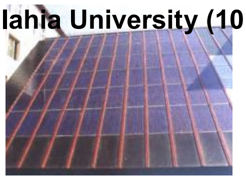
- **a.** For each MWh of renewable electricity delivered to the grid from new or refurbish plant , producers receive **1 green certificate**
- **b.** For each MWh of renewable electricity delivered to the grid from *Solar energy* , producers receive **3 green certificates**
- **c.** For each 2 MWh of renewable electricity delivered to the grid from *Hydro power plant ≤ 10MW*, producers receive **1 green certificate** (which don't correspond conditions to letter a.)

1 green certificate can be traded for prices between established limits of EUR **26,2 - 46,2/ certificate**

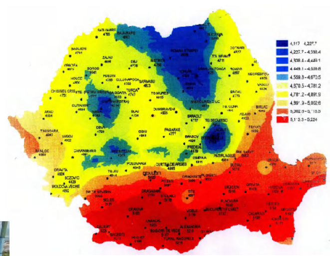
SOLAR ENERGY

-Polytechnic University of Bucharest (30 kW)

- Valahia University (10 kW)



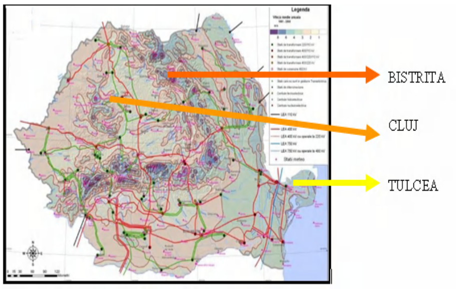
ROMANIAN SOLAR RADIATION MAP



Giurgiu

Mangalia

WIND ENERGY



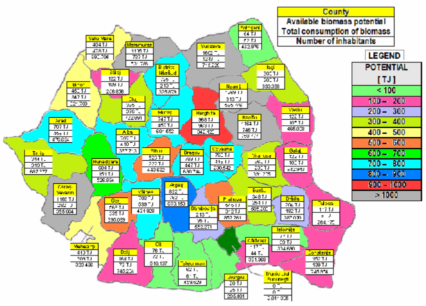
	PRODUCER	RES	P_i [MW]
1	S.C. ILEXIMP S.R.L.	wind	0,250
2	S.C. ECOPROD ENERGY S.R.L.	wind	0,660
3	S.C. PENTIUM S.R.L.	wind	1,650
4	S.C. BLUE LINE IMPEX S.R.L.	wind	0,285
5	S.C. ELECTROGRUP S.R.L.	wind	1,035
6	S.C. ELECTRO MARGO LINE SRL	wind	0,285
7	S.C. E MARKET S.R.L.	wind	0,300
8	S.C. ELECTRIC PROD S.A.	wind	0,600
9	S.C. SERVOPLANT ECO ENERGIE S.R.L.	wind	0,090
10	S.C. GREEN ENERGY GRUP S.R.L.	wind	0,750
11	S.C. HYDRO WIND POWER S.R.L.	wind	0,750
12	S.C. GERVIS S.A.	wind	0,990

	PRODUCER	RES	P_i [MW]
1	Energy Holding S.R.L.	hydro	5,950
2	UZINSIDER GENERAL CONTRACTOR S.A.	hydro	4,600
3	S.C. HIDRAL INVEST S.A.	hydro	0,760
4	S.C. UZINA MECANICĂ SADU S.A., Filiala C.N. ROMARM S.A.	hydro	1,200
5	S.C. COMPLEXUL ENERGETIC TURCENI S.A.	hydro	9,900
6	S.C. ESPE ENERGIA S.R.L.	hydro	5,080
7	S.C. COLTERM S.A.	hydro	1,200
8	S.C. TERMOFOREST S.R.L.	hydro	0,526
9	S.C. ELECTROMAGNETICA S.A.	hydro	4,069
10	S.C. HIDROCONSTRUCŢIA S.A.	hydro	0,600
11	S.C. EVIVA HIDRO Bucureşti	hydro	0,202
12	S.C. APAVIL S.A. VÂLCEA	hydro	0,710
13	Administraţia Naţională "APELE ROMÂNE"	hydro	1,304
14	S.C. ROMELECTRO S.A.	hydro	1,640
15	S.C. RAFINĂRIA STEAUA ROMÂNĂ	hydro	0,820
16	S.C. Exploatare Sistem Zonal PRAHOVA S.A.	hydro	0,290
17	S.C. ELSID S.A.	hydro	8,197
18	S.C. NEPTUN S.A.	hydro	0,071
19	S.C. SOBIS Solutions S.R.L.	hydro	0,236

The hydro power is the most important RES in Romania

	PRODUCER	RES	P_i [MW]
20	S.C. ISPH S.A.	hydro	12,470
21	S.C. HIDROELECTRICA S.A.	hydro	143,798 39,800
22	S.C. LUXTEN LIGHTING COMPANY S.A.	hydro	10,525

Biomass



The biomass energy potential amounts to 318 PJ/year,
- 49.2 PJ waste materials from wood processing industries and fuel wood,
- 20.4 PJ sawdust and other wood wastes,
- 200.9 PJ agricultural wastes,
- 22.8 PJ municipal wastes
- 24.6 PJ biogas.

Project "Sawdust 2000"

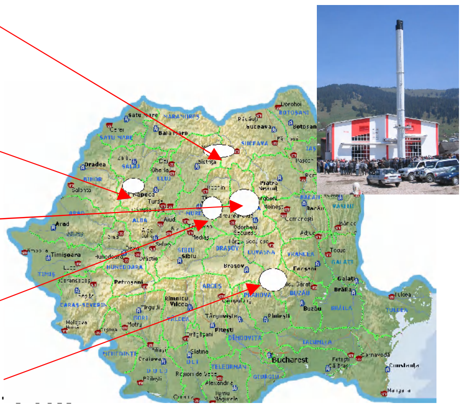
Vatra Dornei 12 MW

Huedin- -4 MW

Gheorgheni 6 MW

Vlăhița-6 MW

Întorsura Buzăului



BIODIESEL

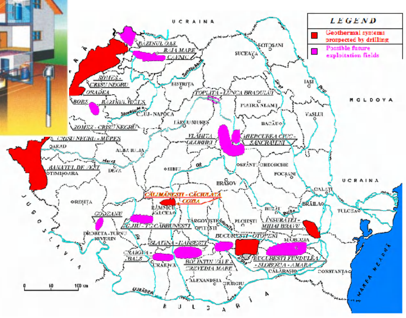
Investments:

- ***Auto Elite Baia Mare*** – 50.000 t biodiesel/year
- ***Lehliu Gara*** - Martifer Portugal -rafinery and oil processing plant, 100.000 t biodiesel/year, capacity:50.000 ha rape seed crop
- ***Ultex Ţăndărei*** - processes 175.000 tones of grains soy, 4500 t biodiesel/year
- ***Ulerom Vaslui*** - 60.000 t biodiesel/year, with further possibilities to attain 120.000 t biodiesel/year.
- ***Rompetrol Rafinary*** – 60.000 t /year capacity
- ***Expur Urziceni*** - swiss firm ALIMENTA
- ***ATEL, LOAMNES*** – Sibiu - MAN Ferrostaal Germany, 400 t /day

Integration of RES electricity in the CEE Region - Budapest, 20-21.05.2008 19

GEOTHERMAL POTENTIAL IN ROMANIA

At Ministry of Administration and Interior there is PILOT PROGRAM : 10 schools will be equipped with heat pump that replace stoves and decrease pollution.



Applications:

– Oradea
– Calimanesti – Caciulata
– North Bucharest (Otopeni)

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Financial schemes to support energy efficiency and renewable projects

- **The National program for the reduction of energy costs for the population, by increasing energy efficiency and using renewable sources of energy**

2006-2007- development of district heating networks for: Vatra Dornei and Vlăhita.
2006 - the utilization of geothermal energy in housing from Livada and Săcueni .
- commissioning of the micro hydro power plants to power the public lighting in the city of Geoagiu.

- **FREE** (Romanian Energy Efficiency Fund) is a revolving fund established by World Bank.
- **Environmental Fund** is a fund supplied by penalties for pollution and state budget. Only renewable projects could be financed from this fund, not energy efficiency
- **ESCO** in Romania
- **Third Party Financing** (TPF)
- **Long Term Agreement** (LTA)

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THANK YOU FOR YOUR ATTENTION !

Presentation on :
RENEVABLE ENERGY SOURCS IN POLAND – EVOLUTON CURRENT STATE AND POSSIBILITIES OF DEVELOPMENT

by
Dr. Hanna Bartoszewicz-Burczy
Institute of Power Engineering

Meeting on:
„Integration of more Renewable electricity in the CEE Region: network or support problem?”

Budapest, 20 – 21 May 2008

1. BASIC INFORMATION ON POLAND

- **Poland is a medium size country: the population - 38,1 million, area - 312,7 th km^2 .**
- **From 1990 Poland survived the economic and political transformation from the centrally planed to the marked economy.**
- **During the last years Poland has strong economic growth – GDP rate reached 4-7% per year.**
- **Since 1996 Poland is a member of OECD, in 1999 joined to the North Atlantic Treaty Organisation (NATO) and since 1 May 2004 Poland is a member of the European Union.**
- **In 1995 the electric system of Poland was interconnected with the Westerns European System (UCTE).**
- **In 1997 the Parliament has passed the basic legal act: The Energy Law.**

2. GENERAL FEATURES OF ENERGY ECONOMY

- **Poland has relatively large resources of hard coal and brown coal, modest reserves of natural gas, insignificant of crude oil and small hydro potential.**
- **Poland still is a significant producer and exporter of coal but large importer of oil and natural gas.**
- **Primary energy consumption – 96,7 Mtoe in 2006, 2,38 toe/capita.**
- **Electricity consumption – 136,7 TWh, 3588 kWh/capita in 2006.**

  Electricity production is based on big producers use fossil fuels
- **RES production was 228 PJ (6.5% of primary energy production) in 2006.**
- **Renewable energy is applied in Poland in power sector (hydro electricity, wind) and in small scale, especially in small towns, individual houses.**

Gross electricity production- export + import – network losses

3. RES INSTALED CAPACITY AND NUMBER OF INSTALATIONS

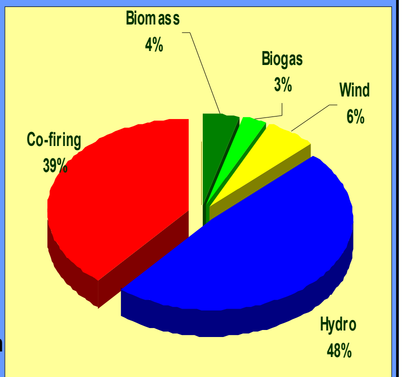
	Installed capacity MW 2005	2006	Number of installations 2005	2006
• Biomass	51,0	50,7	7	6
• Biogas	32,7	35,3	67	74
• Wind	123,5	173,1	64	108
• Hydro	921,7	930,6	672	689
• Co-firing	-	1700		
TOTAL	1128,9	1189,7 (without c-f)	826	895

- **Since 2005 wind power capacity has increased by ca. 200% in Poland.**
- **Since 2006 rapidly growth in biomass co-firing in conventional power plants.**

Source: [6], [7]

4. GROSS ELECTRICITY PRODUCTION BY KIND OF RES GWh

	2005	2006	Growth %
• Biomass	163,1	180,1	110
• Biogas	110,2	115,7	105
• Wind	135,5	256,1	189
• Hydro	2201,1	2042,3	93
• Co-firing	1237,3	1645,2	133
- biomass	1236,7	1644,6	133
TOTAL	3847,2	4239,5	111



Structure of RES el production in 2006

- RES production has continued to increase in recent years.
- High growth rates are being for wind and biomass.

Source:[6], [7].

5. EUROPEAN UNION POLICY AND LOW

- **RES obligations result from Poland membership in the EU and from other international agreements.**
- **The obligation are:**
  - **- achieving 6% reduction of CO_2 emission in 2008-2012 comparing the 1988 level – Kyoto Protocol in 2002,**
  - **- achieving 7,5% share of electricity produced from RES in the gross electricity consumption – implementation Directive 2001/77/EU,**
  - **- achieving 15% share of electricity from RES in 2020 - Lisbon European Council – III 2007 .**
- **Those obligations are included in the strategic documents that shape Polish ecological policy and energy policy and in the main legal act– Act on Environment Protection, the Energy Law and Ordinances to this acts.**

6. TARGETS FOR ELECTRICITY FROM RES

- The obligation of buying or producing electricity form RES is fulfilled if in each enterprise the share of electricity with the certificates of origin in the total sale of electricity in a given year is not lower than:
- Ordinances of Ministry of Economy

		3.11.2006	New
-	2008	7,0%,	7,0%
-	2009	8,7%,	8,7%
-	2010	10,4%,	10,4%
-	2013	10,4%,	10,9%
-	2014	10,4%.	11,4%
-	2015		11,9%
-	2016		12,4%
-	2017		12,9%

In 2005 and 2006 the obligation has been fulfilled with a surplus and hasn't in 2007.

7. INSTRUMENTS TO SUPPORT RES e IN POLAND

- The Energy Law together with the Ordinance of Ministry of Economy create the incentives for promotion electricity production from RES in particular:
  - quota obligation system - obligation on electricity suppliers with targets specified from 2005,
  - system of penalties for non- compliance the obligations,
  - directing the funds achieved from substitute payments and fines to financial support of investments in RES,
  - the obligation to buy all the electricity produced from RES,
  - decrease by 50% the costs of connecting RES to the grid,
  - facilitation of wind power plants,
  - priority of transmission services for the energy from RES.

8. RES TECHNICAL POTENTIAL AND UTILISATION

	Technical potential	Share	Utilisation	
	PJ/a	%	PJ/a	%
1. Biomass	755	43,1	164	21
2. Water	49	2,8	8	16
3. Geothermal	220	12,6	0,5	0,2
4. Wind	281	16,1	0,02	0,08
5. Sun	445	25,4	0,03	0,06
6. TOTAL	1750	100	173	10

- **Biomass is the dominant source and has large share of utilisation**
- **The potential of wind energy and geothermal are also high but there are used in small scale.**
- **The potential of water is low but it used in 16%.**

Source: [4], [5].

9. BIOMAS POTENTIAL

- **The biomass economic potential is 600 PJ/a in this:**
  - solid dry biowest 166 PJ/a,
  - biogas 123 PJ/a,
  - forestry products 24 PJ/a,
  - agricultural residues 287a.
- **It's expected further increase of biomass use for electricity,**
  - high growth rates of co-firing in CHP.
- **There exists a huge potential of the increase the energy crops plantations.**
- **Biogas for electricity - further development gas from waste dumps, sewage and from plantation as well as.**
  - foreseen capacity 2-3 GW in 2020.

10. WIND POTENTIAL

- **Economic potential - 445 PJ/a in this:**
  377 PJ /a on land and 67 P/a off-shore.
- **Most favourable conditions for wind energy are in the northern and eastern parts of Poland.**
- **Current situation:**

- installed capacity	**269 MW**	**8 farms**
- forecast capacity	**3723 MW**	**81 farms**
TOTAL	**3992 MW**	**89 farms**

- **A rapid development of the installed capacity based on wind energy is foreseen in the nearest future.**
- **The planed projects to 2020: 7 - 8 GW mainly in the north part of Poland.**

Source: [9].

11. HYDROENERGY

- **Economic potential of hydroenergy in Poland are not high, they are estimated to about 18 PJ/a.**
- **Current situation:**
  - ca. 700 small hydropower stations.
- **Hydropower still remains the largest RES source in the electricity:**
  - total electricity production – ca. 4 TWh .
- **Forecast:**
  - to 2020 is foreseen development of small hydro power stations to ca. 11 PJ .
  - building new big hydropower plants are not expected in the nearest future.

12. SOLAR AND GHEOTHERMAL ENERGY

- **Solar energy**
  - The economic potential of solar energy in Poland are relatively high (83 PJ/a) , but with high irregularity of solar radiation.
  - The photovoltaic installations produce electricity used for supplying telecommunications devices, lighting road signs, and a few installations are used by individual users or by local societies.
- **Geothermal water**
  - Majority of the water is characterised by low enthalpy and high mineralization.
- **Geothermal water and solar will not be significant in electricity production to 2020, but there exist the possibility to increase utilisation of those sources.**
- **The wider application of this technologies will be possible as their costs come down.**

13. Warsaw University of Technology Centre for Photovoltaics

14. CONCLUSIONS

- **Poland has a considerable potential of biomass.**
- **Potential of other RES resources are relatively poor, because we have limited hydro and wind potential as well.**
- **In spite of limited RES resource we expected faster and significant growth of renewables energy utilisation for electricity generation due to:**
  - security of supply,
  - decrease of dependence from primary energy sources,
  - reducing the atmospheric pollution,
  - counteracting the climate change,
  - developments of agricultural regions .
- **It is necessary to stress that achievement of 15% electricity from RES in 2020 according to EU Council Decision will rather difficult task.**

14. CONCLUSIONS cont.

- **Additional efforts are needed to reach this target:**
  - increase of financial support for new RES,
  - development of grid connections and available capacity,
  - improvement of administrative procedures for new RES,
  - increase social awareness of the benefits of RES .

THANK YOU FOR YOUR ATTENTION

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LABORATORY OF REGIONAL ENERGY DEVELOPMENT

INTEGRATION OF MORE RENEWABLE ELECTRICITY IN THE CEE REGION:
NETWORK OR SUPPORT PROBLEM?

RENEWABLE ENERGY SOURCES FOR ELECTRICITY PRODUCTION: STATUS IN LITHUANIA

Vaclovas Kveselis

National targets (NES)

Lithuania will implement its commitments to the EU on the use of renewable energy resources for generating electricity. With wind power plants, small hydropower plants and bio fuel burning CHP plants being constructed within the next five years, the share of renewable energy resources in the total electricity generation balance will account for over 7% in 2010, while at the end of the forecasting period their input should increase to 10%. The possibilities of constructing hydropower plants complying with environmental requirements will be considered, exploiting the potential of the River Neris and its basin.

Efforts will be made to increase the share of renewable energy resources in the primary energy balance by 1.5% each year until 2012 and by 2025 to reach 20%.

The share of renewable energy resources in the national balance of primary energy increased in 2005 up to 8.7%, and in 2010 one of the country's strategic objectives will be attained – the share of renewable energy resources will increase up to 12%. With the construction of all the wind power plants whose construction has already begun and the power plants working on biofuel, over 7% of electricity will be generated in 2010 by using renewable energy resources.

Fiscal Measures to Promote Use of Renewable Energy Sources in Lithuania (1)

- **Purchasing obligation** - Pursuant to the Regulations for Public Service Obligations holders of the supply license and public supply license are obliged **to purchase all electricity generated using renewable energy sources** from its producers at the established prices and sell it to their customers.
- **Transportation priority** - The Regulations for Public Service Obligations provide for the obligation for the supply network operator **to ensure priority transportation of electricity generated from renewable energy sources** via electricity transmission networks in the situation when the grid has limited conductivity.
- **Feed-in tariffs** - As from 2002 feed-in tariffs have been applied for the purchasing of electricity generated using renewable energy sources:
- hydro power plants - 20 ct/kWh (5.8 €cent/kWh)
- wind power plants - 22 ct/kWh (6.4 €cent/kWh). (30 ct/kWh (8.7 €cent/kWh) since 2009)
- Since 2008 a new tariffs have been applied for the purchasing of electricity generated using biofuel:
- biofuel power plants, the operation of which was started before 2008 - 22 ct/kWh
- biofuel power plants, the operation of which will be started after 2008 - 24 ct/kWh.
- These tariffs will be maintained until 31 December 2020.

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Fiscal Measures to Promote Use of Renewable Energy Sources in Lithuania (2)

Discount on the fee of connection of power plants to the network - Generators whose power plants are using renewable energy sources for electricity generation **are subject to a 40 % discount for the connection to the network** of operating energy plants.

Exemption from excise tax- **The electricity shall be exempted from excise if electricity is generated from renewable energy sources** (This provision will come into force since 1 January 2010).

EU Structural Funds - In order to enhance the use of the renewables in Lithuania it is expedient to build a new boiler-houses or to modernize a part of the old ones for the use of the renewables (ES Structural assistance for Lithuania for the period 2007-2013 will be allocated in accordance with National Strategic Reference Framework for Lithuania for 2007-2013 and with operational programs. The funds from Operational Program for Promotion of Cohesion for 2007-2013 will be budgeted for mentioned activity).

Exemption from the pollution charge - Physical and legal persons, upon presentation of documents proving consumption of biofuel in mobile pollution sources shall be exempted from the payment of the pollution charge for emission of air pollutants which emerge during combustion of biofuel.

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RES consumption and potential

Source: www.avei.lt

Sort of RES sources	Consumption, TWh			Potential, TWh/year
	In 2006	**In 2010**	**In 2020**	**In 2020**
Wood	8.46	9.50	9.80	9.80
Straw	0.019	0.50	1.50	3.59
Municipal waste	0.00	0.00	0.46	0.80
Landfill gas	0.023	0.14	0.28	0.10
Biogas				0.30
Geothermal energy	0.0097	0.11	0.11	0.80
Small HPP	0.397	0.46	0.58	0.50
Large HPP				1.00
Solar energy	0.00	0.00	0.00	1.30
Wind energy	0.0137	0.29	0.85	0.85
Biofuel	0.28	0.72	0.72	2.25
Total:	**9.2024**	**11.72**	**14.3**	**21.29**

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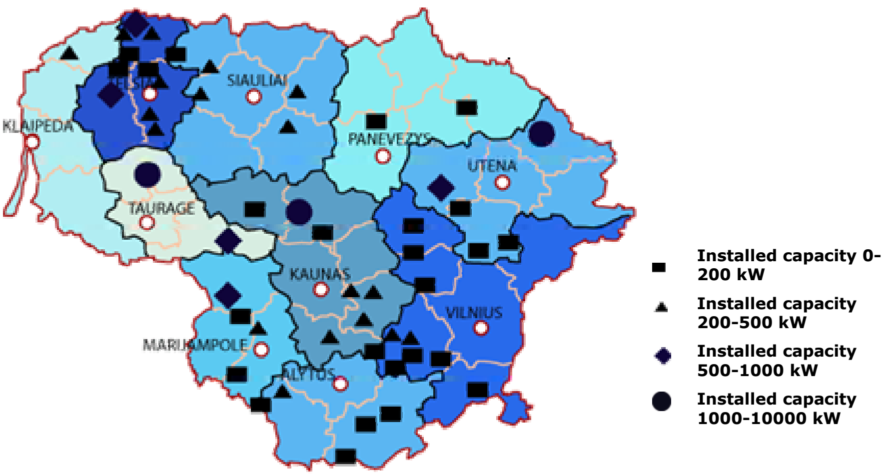
Newly installed small hydro power plants

Source: www.avei.lt



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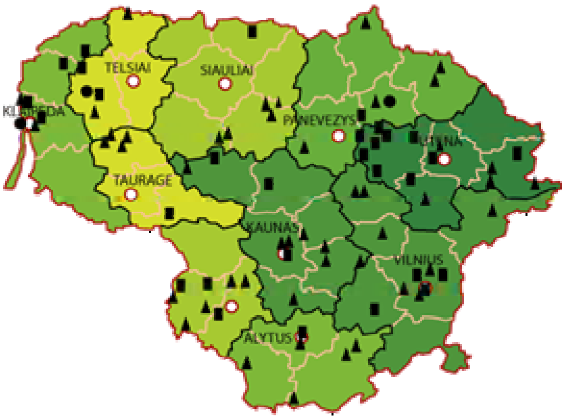
Wood boiler-houses & power plants

Source: www.avei.lt



- ■ **Installed capacity 0.2-1 MW**
- ▲ **Installed capacity 1-10 MW**
- ● **Installed capacity more than 10 MW**

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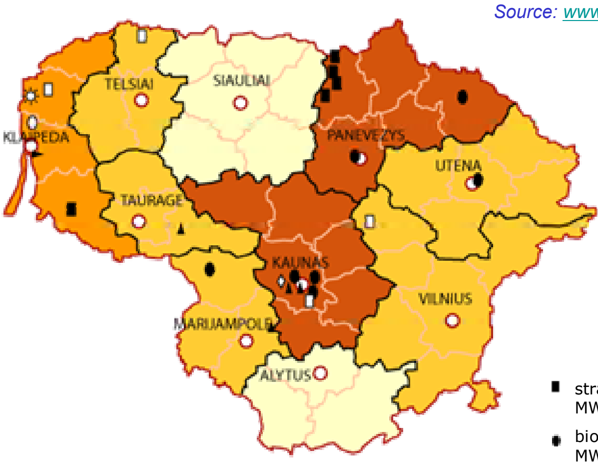
7

Other plants using RES

Source: www.avei.lt



- ■ straw (N = 0.3-1.5 MW)
- ▲ peat (N = 0.5-9.0 MW)
- ● biogas (N = 0.3-7.8 MW)
- solar (N = 0.0073 MW)
- geothermal (N = 17 MW)
- □ mixed fuel sources (N = 0.05-10.0MW)
- combined heating systems (N=0.6 MW)
- ---------------- (N=0.63 MW)

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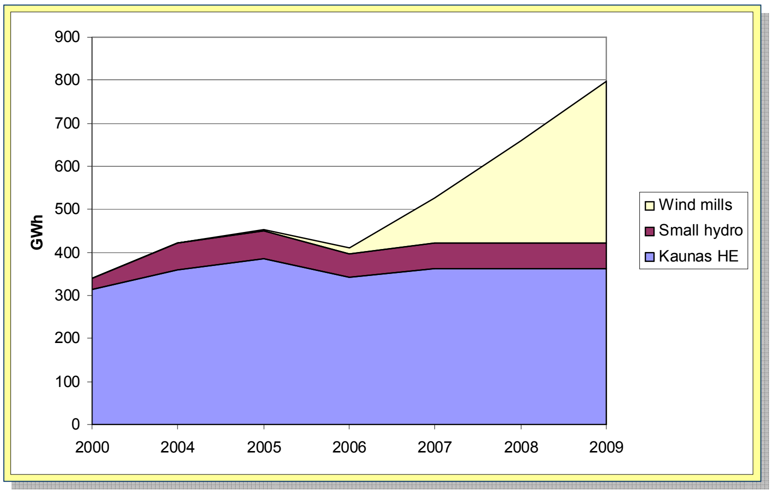
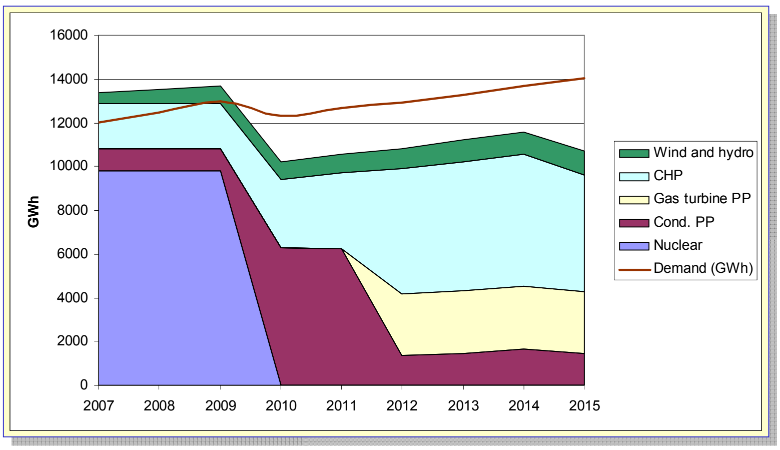
8

Development of electricity production from RES



Lithuanian electricity balance after closure of Ignalina NPP



Barriers and opportunities

Barriers	Opportunities
Relatively cheap, clean and abundant electricity from nuclear power plant	Closure of Ignalina NPP in 2010
Lack of economic motivation for RES electricity producers	Growth of fossil fuel prices increases attractiveness of RES
Lack of proven technologies for some potential sources	ES and local Policy support, technology development
Grid reinforcement issues for large scale wind farms	Benefits from ETS

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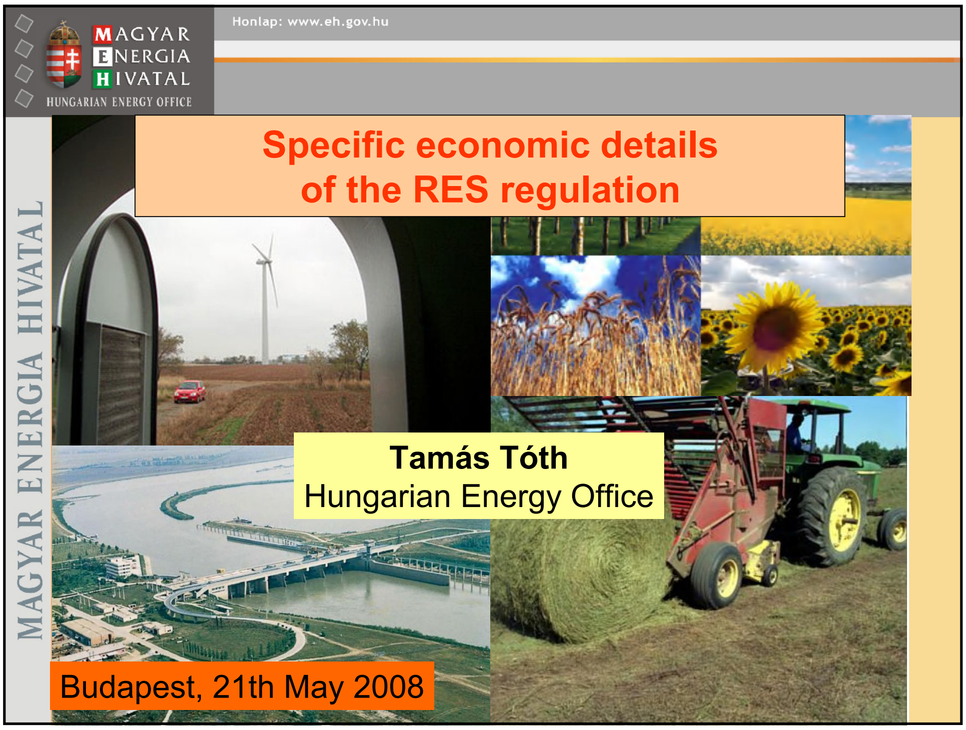

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EU expectations regarding the support scheme

increase the security of investment

- **Effective**
  - Ensure the RES utilization
  - Enough support for RES >> countable
    >> low risk
- **Efficient**
  - RES utilization at the least cost
  - Low consumer expenditure

create acceptance

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Experiences of the Hungarian support scheme (1)

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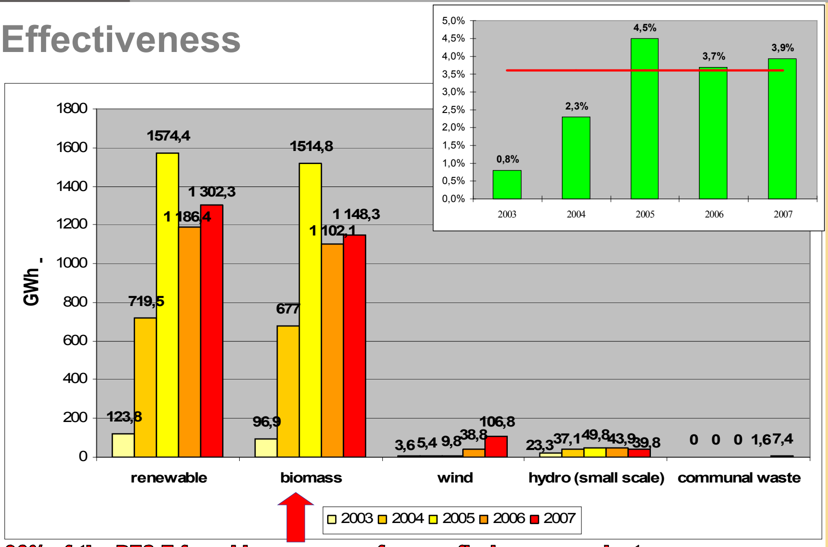
Effectiveness



98% of the RES-E from biomass came from co-fireing power plants

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Experiences of the Hungarian support scheme (2)

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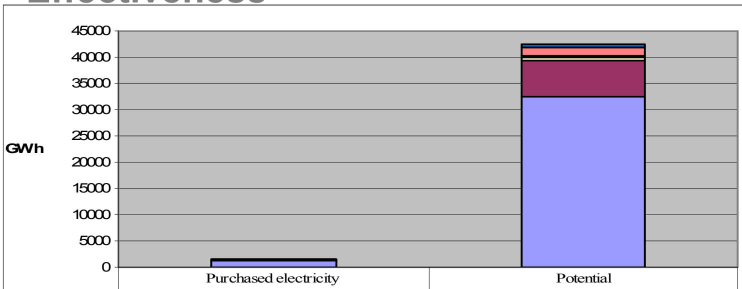
Effectiveness



	Purchased electricity	Potential
PV	0	550
wind	107	1660
small hydro	40	60
large hydro	165	200
geothermal	0	600
biogas	13	6940
biomass	1135	32500

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Experiences of the Hungarian support scheme (3)

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Efficiency

Main features of the Feed-in-tariff system

1. **obligatory taking over and feed-in-tariff for RES-E (only for the licensed period and amount)**
2. **Hungarian Energy Office (HEO) sets the amount of RES-E and the period of the obligatory taking over in the license**
   - Individually project inquiry
   - Period and amount depend on the submitted business plan (depend on the return period of the investment)
3. **Feed-in-tariff is set by the Act (VET): average tariff 9 EURcent/kWh*k (k= last year inflation rate)**
   - By wind, PV at all day periods the same tariff
   - By the others depend on the electricity demand at day periods the tariffs are different, but the averege tariff is the same

Price is fixed **Length of supported period is variable**

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Experiences of the Hungarian support scheme (4)

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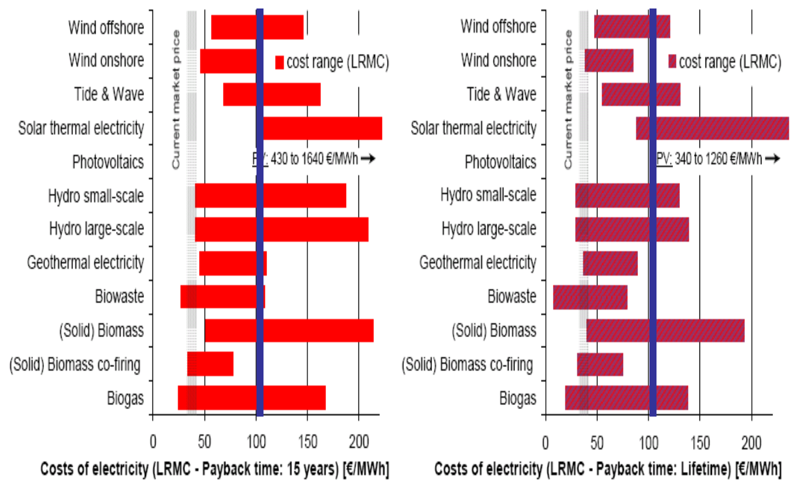
Efficiency

No really diferentiated feed-in tariff: 10,5 EUR/MWh



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Experiences of the Hungarian support scheme (5)

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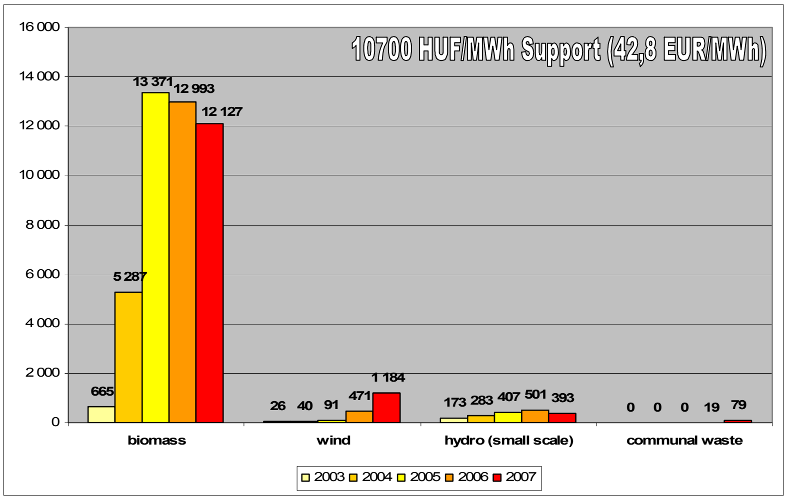
Efficiency

	2003	2004	2005	2006	2007
RES-E:	0,9	5,6	13,9	14	13,8 (in billion HUF)



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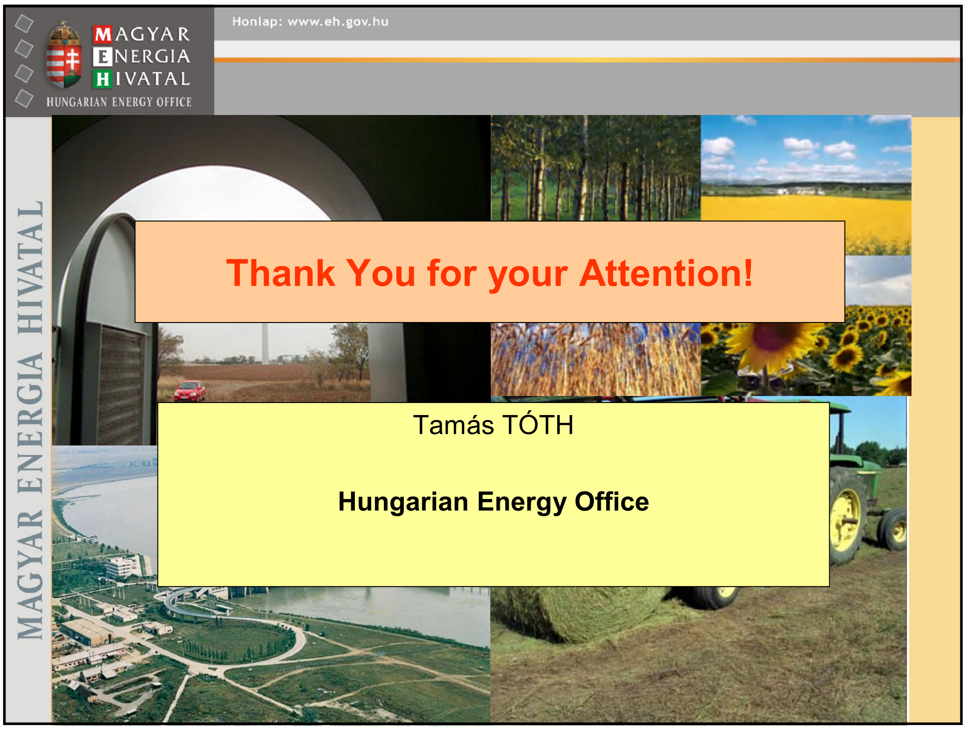
New draft (uniformized payback period calculation)

- **Based on:**
  - net present value calculation of a benchmark power plant
  - Datas of domestic RES power plants, international experiences
- **Result**
  - **Biomass** (firewood, agricultural waste, liquid biomass) **10-12 years** (depend on the size)
  - **Biomass** (energy plantation) **12-14 years**
  - **Biogas** (with gasstation) 11-12 years (without gasstation) **7 years**
  - **Waste 8 years**
  - **Geothermal 15 years**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Thank You for your Attention!
Tamás TÓTH
Hungarian Energy Office

0

WIND PROJECTS INTEGRATION IN LITHUANIAN ELECTRICITY NETWORK

Vaida Tamašauskaitė

Energy Development Department
Lietuvos energija AB

Budapest
2008-05-21

THE STRUCTURE OF ENERGY SECTOR IN LITHUANIA

1

PRODUCTION
- 3 production companies
- 3 CHP of district heating companies
- Few private mini HPP
- Few industrial power plants

DISTRIBUTION
- Two distribution companies (one private)

TRANSMISSON
- One Transmission System Operator company – Lietuvos Energija AB

LIETUVOS ENERGIJA

LIETUVOS ENERGIJA AB

2

- **Owns:**
- 110-330 kV transmission grid;
- Kaunas HPP and Kruonis HPSPP;
- The dispatch centre;
- The telecommunications and information system;
- Kauno energetikos remontas UAB (civil works);
- Energetikos pajėgos UAB (design).

- **Main functions:**
- Maintenance and Development of Transmission System
- System Operation
- Market Administration
- Security of Supply in Lithuania

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GENERATION CAPACITIES IN LITHUANIA

3

Power plants	Installed\available capacity
Ignalina Nuclear PP	**1300 / 1183**
Lithuanian PP	1800 / 1732
Mažeikiai CHP	160 / 148
Vilnius CHP	372 / 355
Kaunas TPP	170 / 161
Petrašiūnai TPP	8 / 7
Klaipėda CHP	11 / 9
Panevėžys CHP	35 / 33
Auto producers	75 / 73
Total thermal PP:	**2632 / 2519**
Kaunas HPP	101 / 51
Kruonis PSPP	900 / 760
Small hydro PP	26 / 26
Total hydro PP:	**1027 / 837**
Biofuel PP	19 / 18
Wind PP	52 / 52
Total renewable PP:	**71 / 70**
Total:	**5030 / 4609**

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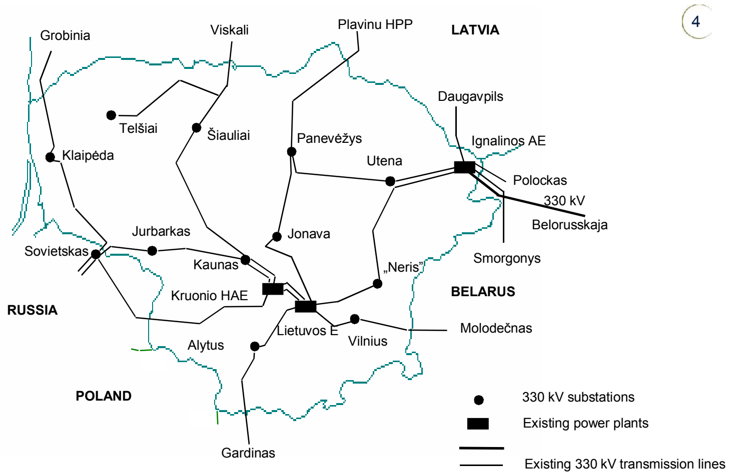
TRANSMISSION GRID

4



	110 kV	330 kV	Total
Length of overhead lines, km	4970	1670	6640
Length of underground lines, km	21		21
Substations		12	12
Switchgears	213		213
Total capacity of transformer, MVA	143	3325	3468

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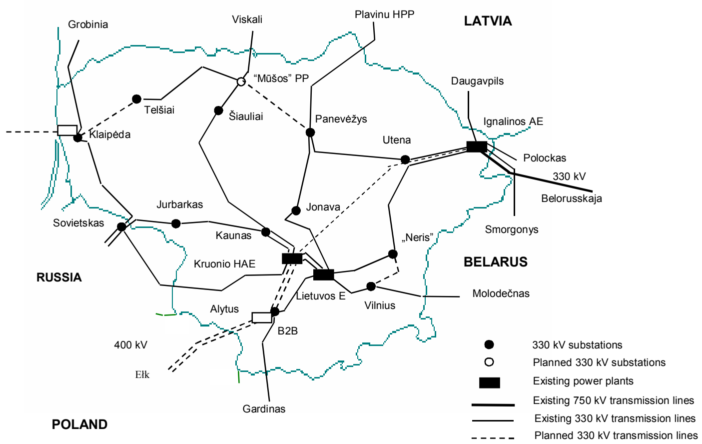
TRANSMISSION GRID DEVELOPMENT 2006 – 2016 M.

5



3

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MAIN LEGISLATION ACTS REGULATING RES DEVELOPMENT

6

- National energy strategy.
- Law on energy.
- Law on electricity.
- Decree for approval of technical requirements for wind power plants for connection to the Lithuanian power system.
- Rules for connection of new consumers to the existing networks.
- Law on promotion electricity production from renewable energy sources.

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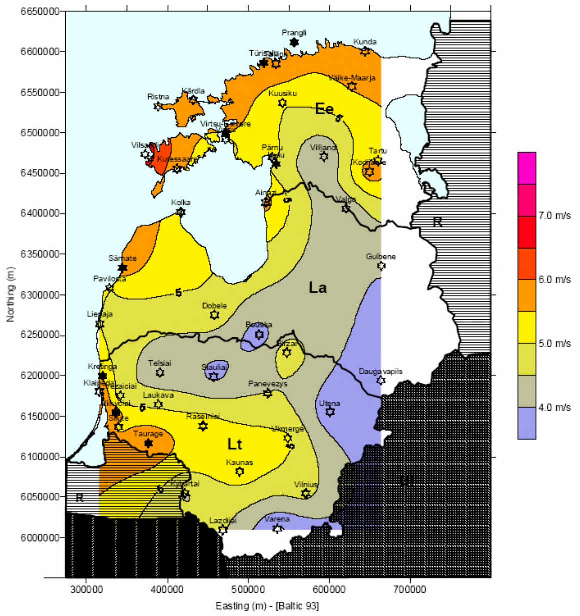
WIND RESOURCES IN THE BALTIC STATES

7



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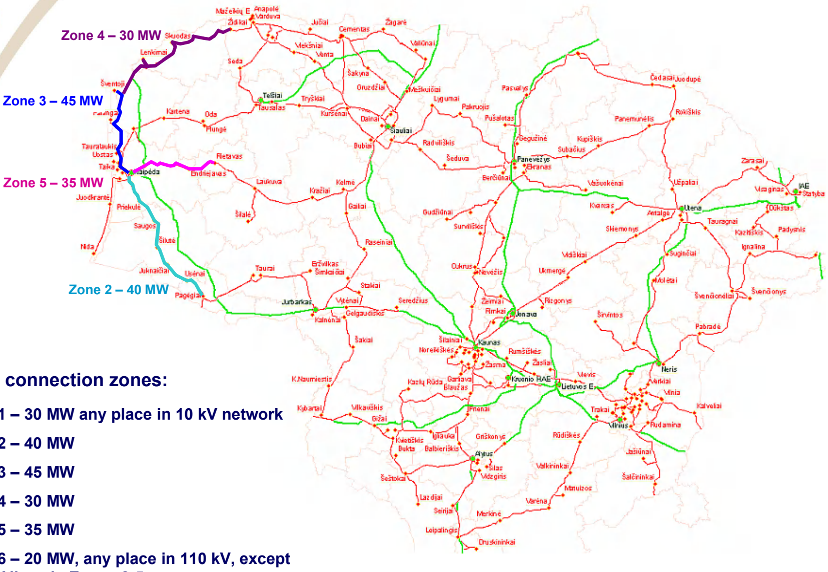
WIND POWER DEVELOPMENT ZONES IN LITHUANIA



Wind connection zones:

Zone 1 – 30 MW any place in 10 kV network

Zone 2 – 40 MW

Zone 3 – 45 MW

Zone 4 – 30 MW

Zone 5 – 35 MW

Zone 6 – 20 MW, any place in 110 kV, except 110 kV lines in Zones 2-5

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TENDERS FOR WIND FARMS CONNECTION TO THE GRID

9

- Tender goal - choose producers, who can get permissions to build wind farms.
- Separate tenders for different zones.
- Tender participants can be any of physical or legal persons.
- Tender participants get preliminary technical conditions according data they provide to grid operator about wind farm location and geographical place.
- Tender participant formulate the proposal according given technical conditions
- Tender commission choose the best proposal.
- Criterion for best proposal – the highest connection fee for one MW.
- Tender winner will get permission from Ministry of Economy, following procedures the same like for usual producers.

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CONNECTION OF WIND PRODUCER TO THE GRID

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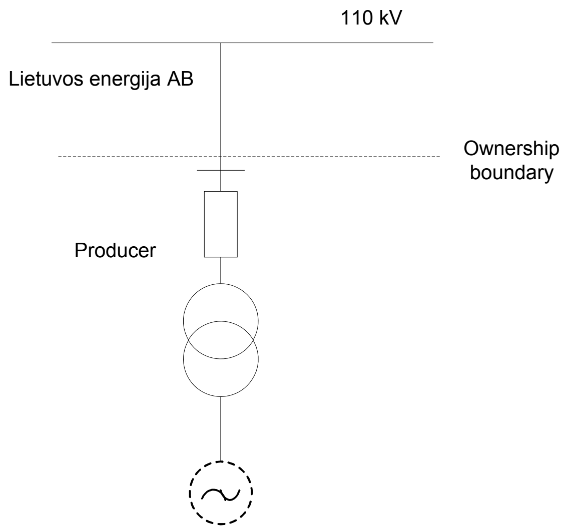

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GRID CONNECTION PROCEDURES

11

1. Preliminary technical conditions from grid operator.
2. Permission from Ministry of Economy.
3. Technical conditions from grid operator.
4. Technical project.
5. Connection agreement.
6. Public tender for choosing contractor for project implementation.
6. Construction works.
7. Technical evaluation commission.
8. Commission for object acceptance as suitable for use.
9. Agreement for buying/selling electricity.

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EXISTING WIND POWER PRODUCERS

12

Producer	Location	Type and capacity of units	Total installed capacity, MW	Output, GWh	Capacity utilization factor	
					hours	%
UAB „Vėjų spektras"	Kiauleikiai village, Kretinga municipality	ENERCON 2.0 MW	30	45.9	2038	23.2%
„Achema" Hidrostotys UAB	Benaičiai village, Kretinga municipality	VESTAS 2.75 MW	16	19.4	2085	23.8%
Total			**46**	**65.3**	**2060**	**23.5%**

LIETUVOS ENERGIJA

13

THANK YOU

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7

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Integration of more Renewable electricity in the CEE region: network or support problem?

- *Within the Renewable Energies Unit in the last two years a project has been carried out to evaluate the effects of the different financial conditions*
- *In these two years more than half of the investment for energy generation investment to new facilities was directed to RES-E (Dexia Bank)*
- *With higher market security (obligatory price, feed-in tariff system) from financial point of view the RES projects became more similar to bonds – so banks became more active in this sector*
- *However they invest where they find the most attractive conditions: Europe competes with North America, Australia, Japan*

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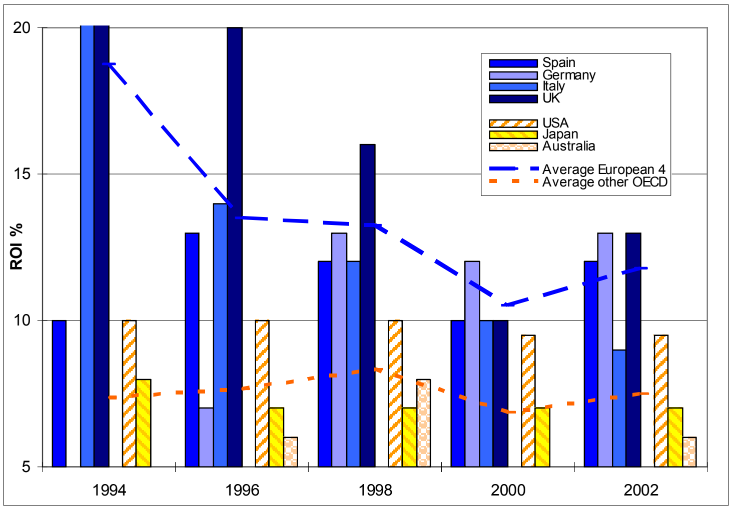
The rational behind the study was the significant difference between the financial conditions of the EU and other OECD countries



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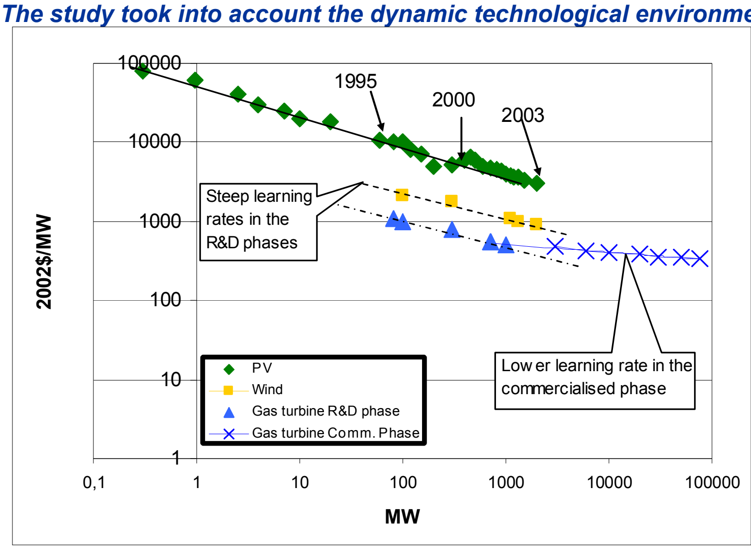
The study took into account the dynamic technological environment



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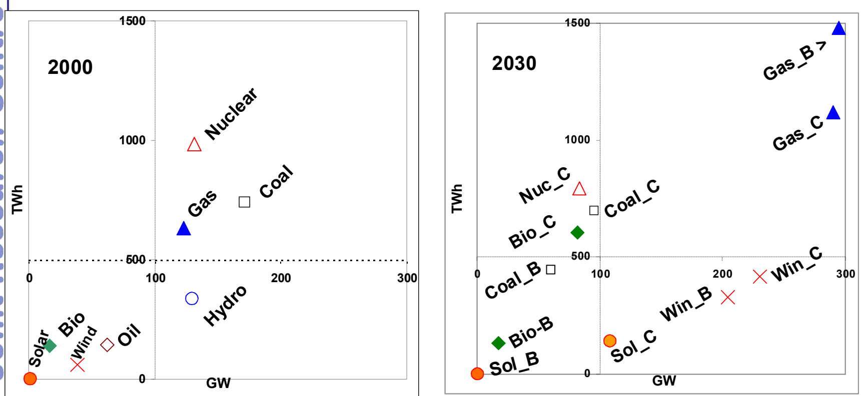
The dominance of gas would only be reduced with the above mentioned gradual capital cost reduction the new energy sources can unlock from the niche market



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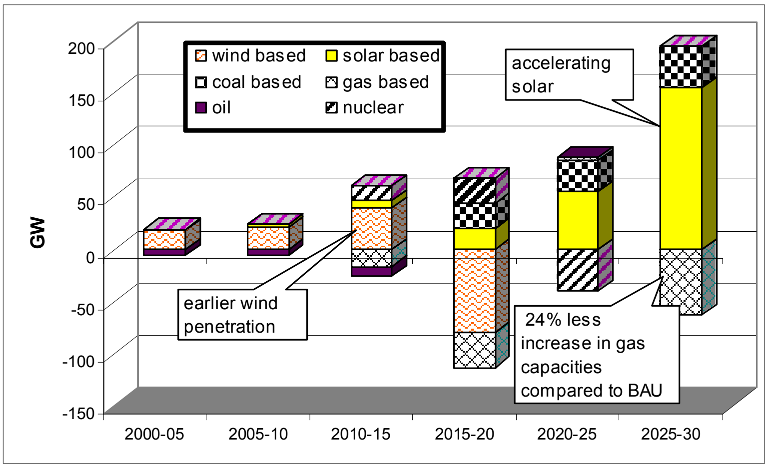
With the gradual reduction of the difference, the lower capital costs would result in the following changes



AND THIS IS NOT ONLY OUR PROJECTION …

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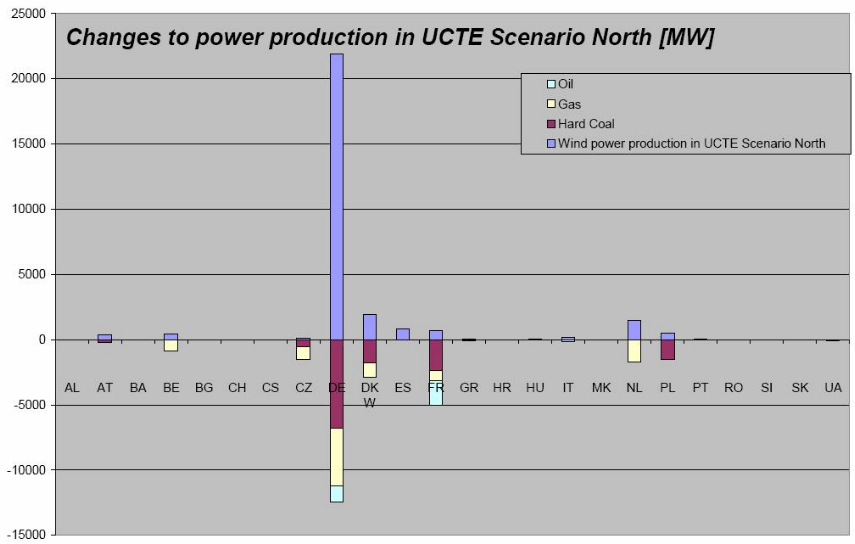

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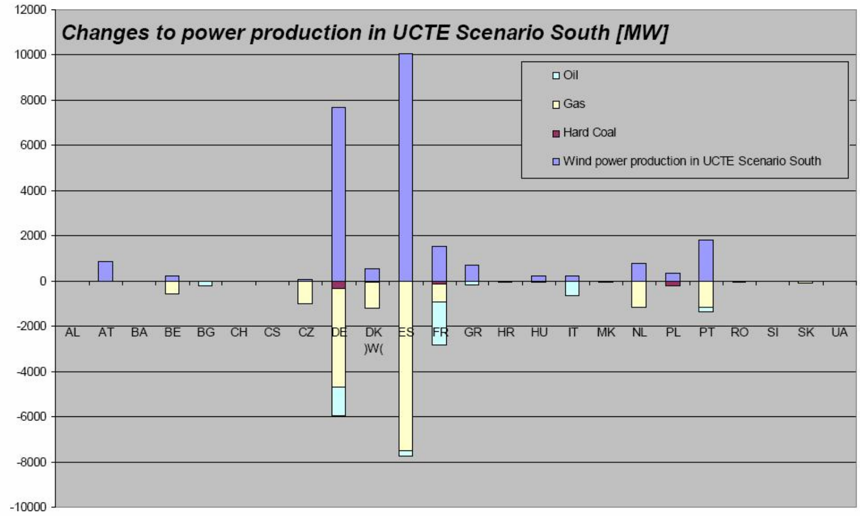

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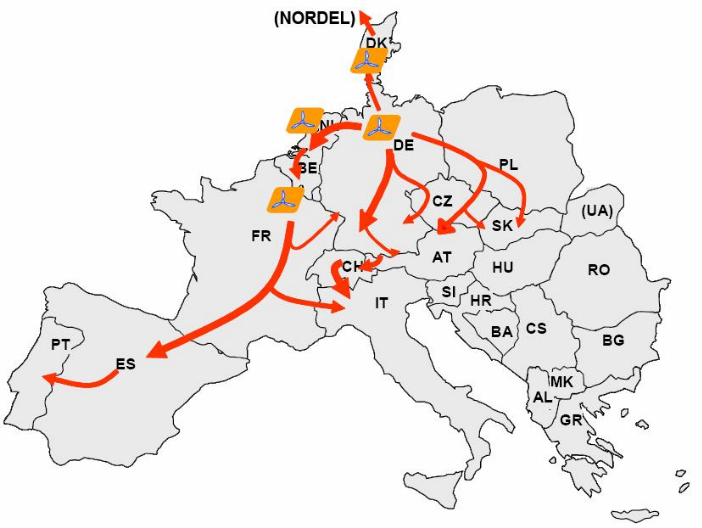

Figure 24: Changes of electrical power transmission in UCTE Scenario North

Source: European Wind Integration Study (EWIS) Towards a Successful Integration of Wind Power into European Electricity Grids
European Transmission System Operators http://www.etso-net.org/upload/documents/Final-report-EWIS-phase-I-approved.pdf

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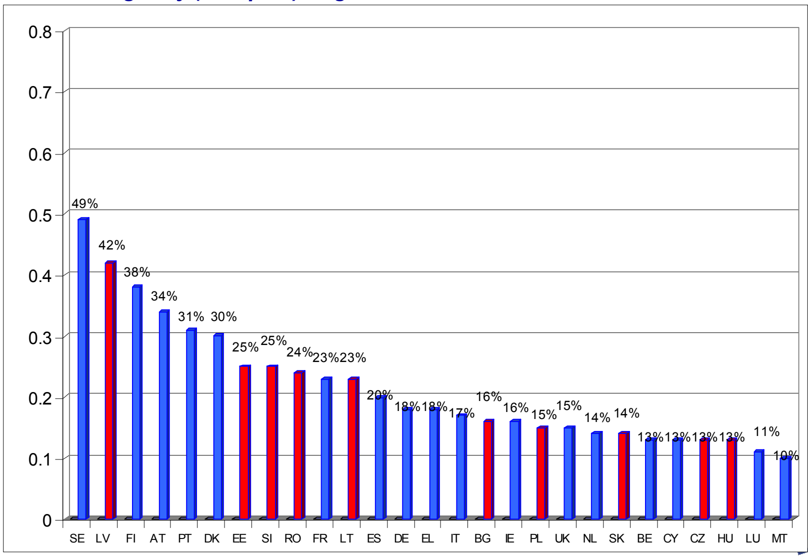
The obligatory (accepted) targets for the Member States in RES-E in 2020



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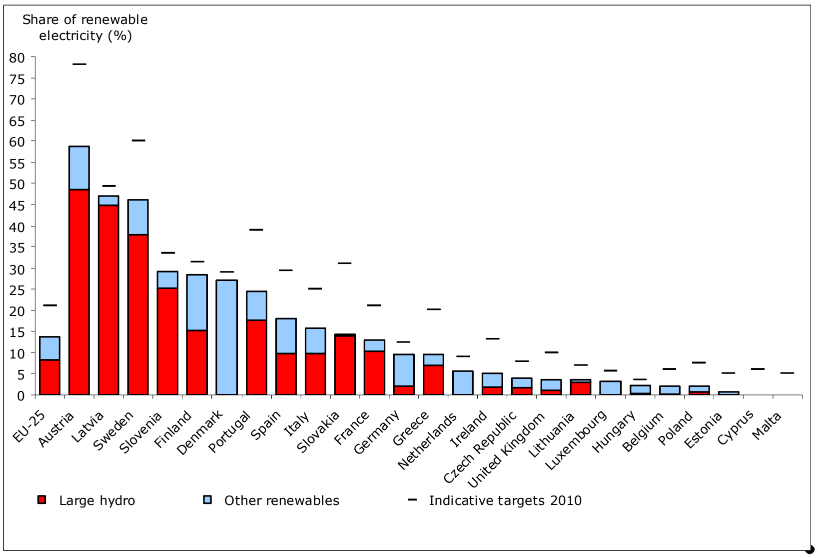

Source: Eurostat

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EUR 23782 EN – Joint Research Centre – Institute for Energy
Title: Integration of More Renewable Electricity in the CEE Region – Network or Support Problem?
Author(s): Sandor Szabo, Zsuzsanna Pato, Arnulf Jaeger-Waldau.
Luxembourg: Office for Official Publications of the European Communities
2008 – 178 pp. – 21 x 29.7 cm
EUR – Scientific and Technical Research series – ISSN 1018-5593

Abstract

The proceeding aims at classifying and ranking the most important factors in CEE countries impeding a more rapid deployment of renewable energy sources for electricity production (RES-E). Another objective is to identify efficient ways to overcome these barriers from demonstrations of successful examples from Member States with longer RES-E integration experience. Some of the best available techniques and country experience with the different policies were presented at the roundtable. The invited experts shared their experiences gained at various institutions: energy regulation offices, grid operating entities, energy production units and quite a few in energy related research organisations. The more rapid development of RES can offer advantages for all stakeholder groups: this win-win situation can be realised if all stakeholders of the market and regulation would be informed better how to benefit from the increased diversification offered by RES. The major benefits can be identified as the following for the stakeholders.

- Regulators can get a better understanding how the problems of larger scale integration the RES sources were overcome in different countries. More sophisticated regulatory mechanisms and better information systems can strengthen the position of regulatory bodies. Improving market conditions, bidding procedures, (ie. day and hour ahead market instead of the monthly schedule), embedding forecasting systems will lead to enhanced regulatory regimes.
- Grid operators are interested in the RES integration challenges, system loss reduction, access conditions, integrating output forecast from intermittent generators that can contribute to improved grid operation methods.
- Power production investors seek low volatility, secure cash flow (feed in tariff), diversification, immunity from oil price changes and carbon prices.
- Researchers quest for innovation and cost reduction by technological learning.

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